



Wisconsin DNR DG/5
PO Box 7921
Madison, WI 53707-7921
Attn: Kassie Lang

WAUKESHA DIVERSION COMMENTS

The success of the Great Lakes Compact is critical to the livelihood of the millions of people that live in the Great Lakes region. The proposed Waukesha diversion represents a crucial first test for the viability of the Great Lakes Compact. As the first proposed "straddling county" diversion, how the Wisconsin Department of Natural Resources ("WDNR") tackles the proposal will set important precedents for future diversion requests, both in Wisconsin, the seven other Great Lakes states and Canada. I write on behalf of the Great Lakes and St. Lawrence Cities Initiative (the "Cities Initiative") to express the comments of American and Canadian Mayors on this issue and respectfully ask the WDNR to labor to set "good" precedent in acting on the Waukesha diversion application.

The Cities Initiative is a binational coalition of Mayors and other local officials that works actively with federal, state and provincial governments to advance the protection and restoration of the Great Lakes and St. Lawrence River. We represent over 100 American and Canadian cities of all sizes. We count the Mayors of the Wisconsin cities of Milwaukee, Racine, Sheboygan, Ashland, Superior and Bayfield among our members.

The importance of this precedent: How the WDNR handles the proposed Waukesha diversion will be felt far beyond Waukesha County and far beyond Wisconsin. The proposed Waukesha diversion is the first diversion sought under the "straddling county" exception to the Great Lakes Compact's general blanket prohibition of diversions of Great Lakes waters to areas outside the Great Lakes basin.¹ The precedential value for Wisconsin alone is enormous: the state has seventeen counties that straddle the Great Lakes basin, with a combined population of 638,450 and area of 6,480 square miles.² All eyes are on the WDNR.

Comments on the proposed diversion: The Mayors would like to register several comments and concerns with the WDNR on the proposed diversion:

¹ Don Behm, *New Waukesha Lake Diversion Documents Tout Benefits to Great Lakes*, MILWAUKEE JOURNAL-SENTINEL (Oct. 14, 2013), <http://www.jsonline.com/news/waukesha/new-waukesha-lake-diversion-documents-tout-benefits-to-great-lakes-b99117997z1-227617921.html>.

² UNIV. OF WIS.-MILWAUKEE, *Q&A: Water Issues in Waukesha*, <http://www.glwi.freshwater.uwm.edu/ourwaters/documents/WaukeshaHandoutBWeb.pdf> (last visited Nov. 13, 2013).

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Réjean Lefebvre, President of Quebec Metropolitan Community, Vice Chair

John Diwerdt, Mayor of Racine, Secretary Treasurer



- 1.) The proposed new Waukesha service area and its western reach: The Mayors are concerned about the diversion of Great Lakes water to the far western reaches of Waukesha County, including to the Town of Genesee and Town of Delafield. The new Waukesha service area greatly expands the existing Waukesha service area and reaches much further from the Great Lakes basin. The spirit of the Great Lakes Compact and the straddling county exception is to minimize the distance of any diversion from the Great Lakes basin. By expanding the Waukesha service area to the western edges of Waukesha County, the proposed service area exacerbates existing concerns about the Waukesha diversion. The Cities Initiative asks that because of the remote nature of the diversion, the WDNR apply a high level of scrutiny to Waukesha's application.
- 2.) The need for Great Lakes water: The Great Lakes Compact and Wisconsin implementing statutes require that any community applying for a diversion under the straddling county exception be "without adequate supplies of potable water."³ The Cities Initiative asks that the WDNR scrutinize Waukesha's assertions that their current water supplies are inadequate. In particular, the Cities Initiative asks for a close examination of Waukesha's claim that the city's current deep aquifer groundwater is not sustainable. Waukesha rests much of its claim on "drastically declining water levels" in the deep aquifer. While it is true that the water table has dropped precipitously since 1960, USGS data shows that the deep aquifer water levels have been relatively stable since 1986.⁴ WDNR should consider the stabilization of deep aquifer water levels when evaluating Waukesha's claim that its existing water source is inadequate. Stabilizing water levels could mitigate or negate Waukesha's concerns about i.) increasing radium concentrations at deeper levels; ii.) increasing total dissolved solids contamination at greater depths; iii.) decreasing well capacity; and iv.) decreasing flow to surface water.⁵

Furthermore, even if Waukesha adequately makes the case that the current service area shows a need for Great Lakes water, WDNR should bear in mind that areas of the expanded service area (e.g., Town of Genesee, Town of Delafield) have demonstrated no need for Great Lakes water and are currently served by existing adequate water supplies.

³ WIS. STAT. § 281.346(4)(e)(1)(a) (2012).

⁴ JIM NICHOLAS, AN ANALYSIS OF THE CITY OF WAUKESHA DIVERSION APPLICATION, 17 (2013) (citing USGS data therein).

⁵ *Id.*

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John Dickert, Mayor of Barrie, Secretary-Treasurer



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Alliance des villes des Grands Lacs et du Saint-Laurent

3.) Waukesha's demand projections: The Great Lakes Compact and Wisconsin implementing statutes require that the "diversion shall be limited to quantities that are reasonable for the purposes for which it is proposed."⁶ The Cities Initiative recognizes that demand forecasting is difficult and assumptions must be made. Nevertheless, we believe that Waukesha's forecast of 10.1 mgd is significantly higher than needed and requires careful scrutiny by WDNR. The Cities Initiative requests that WDNR carefully test Waukesha's assumptions that result in the 10.1 mgd estimate including:

- a. Industrial water use intensity: Is the assumption of 1,297 gallons/acre/day as the high case⁷ for industrial water use intensity a fair assumption? This reflects water use intensity in 2000. Industrial water use intensity in Waukesha now hovers around 600 gallons/acre/day, with a 2008–2012 average of 642 gallons/acre/day.⁸ Waukesha wishes to use the higher level for its projections.

Waukesha claims that the recent levels are unnaturally low and reflect one-time influences. The city argues that "weak economic conditions occurring after the terrorist attacks of September 11, 2001, and the start of the recession in 2008, which resulted in the loss of local industry, reduced industrial water use intensity."⁹ Data belie this claim, however. Milwaukee's metropolitan area (including Waukesha) private industry output increased by 14.7% from 2001–2012.¹⁰ Furthermore, the number of industrial accounts in Waukesha's service area rose from 138 in 2000 to 147 in 2009.¹¹ Accordingly, WDNR should consider use of Waukesha's current, lower industrial water use intensity for modeling future demand. Water use intensity is dropping across all sectors: for example, from 1990–2010, Waukesha's water use decreased 21%, while its population increased 24%.¹² There is no reason to believe that industrial use intensity did not follow a similar efficiency trend regardless of external economic factors.

⁶ WIS. STAT. § 281.346(4)(f)(2) (2012).

⁷ CITY OF WAUKESHA, 1 CITY OF WAUKESHA WATER DIVERSION APPLICATION 3-8 (2013).

⁸ CITY OF WAUKESHA, 2 CITY OF WAUKESHA WATER DIVERSION APPLICATION App. C at 5 (2013).

⁹ *Id.* at 6-3.

¹⁰ BUREAU OF ECON. ANALYSIS, REGIONAL DATA – GDP & PERSONAL INCOME (2013).

¹¹ CITY OF WAUKESHA, *supra* Note 8, at 5-2.

¹² CITY OF WAUKESHA, *supra* Note 7, at 2-5.

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- b. Residential, commercial and public use intensity: Waukesha proposes to model future demand using 2001–2012 average per capita use.¹³ However, recent efficiency measures implemented by Waukesha have brought 2012 levels below their ten-year averages.¹⁴ Overall, residential, commercial and public water use intensity, measured in gallons per capita per day, have marched steadily downwards over the past decade.¹⁵ WDNR should consider modeling the continuation of this long-term trend, or at least using today's levels as the starting point for modeling future consumption.
- c. Unaccounted-for water projections: Waukesha proposes to model future water demand projecting unaccounted-for water at 8% of total use, derived from Waukesha's 2008–2012 average.¹⁶ The Cities Initiative recognizes that this is less than the American Water Works Association target of 10%;¹⁷ nevertheless, the 2008–2012 average is misleadingly high due to the presence of 2011's outlying data point at approximately 12% unaccounted-for water.¹⁸ WDNR should consider removal of the 2011 data point, resulting in a significantly lower calculation of approximately 7% unaccounted-for water. As Waukesha avers in discussing its conservation measures, "historically, [Waukesha] averages 4–8% unaccounted-for water."¹⁹ As Waukesha promises to continue its vigilant monitoring of the system, it may be sensible to project demand using lower numbers for unaccounted-for water than the 8% currently projected.
- 4.) Conservation and efficiency measures: The Great Lakes Compact and Wisconsin statutes require scrutiny of conservation and efficiency measures. The proposed diversion must be implemented so as to incorporate "environmentally sound and economically feasible water conservation measures"²⁰ to minimize water withdrawals and consumptive use. Additionally, Wisconsin law requires that in the case of a straddling county diversion, Waukesha implement conservation and efficiency measures that will result in 10% conservation and efficiency gains.²¹ The Cities

¹³ *Id.* at 3-8.

¹⁴ CITY OF WAUKESHA, *supra* Note 8, at App. C at 3.

¹⁵ NICHOLAS, *supra* Note 4, at 29 (citing Waukesha application data therein).

¹⁶ CITY OF WAUKESHA, *supra* Note 7, at 3-8.

¹⁷ *Id.*

¹⁸ CITY OF WAUKESHA, *supra* Note 8, at App. C at 5.

¹⁹ CITY OF WAUKESHA, *supra* Note 7, at 5-7.

²⁰ WIS. STAT. § 281.346(6)(c) (2012).

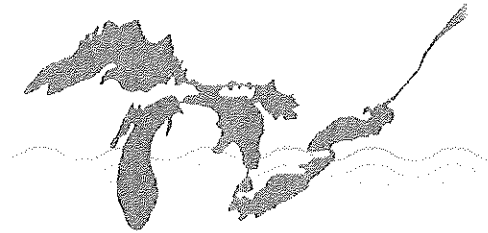
²¹ WIS. ADMIN. CODE DEP'T OF NATURAL RES. § 852.05(3) (2012).

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Initiative requests that WDNR scrutinize Waukesha's proposed measures to ensure that the conservation and efficiency gains will result. To hit this target, Waukesha will need to find approximately 1 mgd in conservation savings.

The Cities Initiative recognizes Waukesha's positive history with water conservation initiatives, but close scrutiny is still due. Waukesha provides a list of important conservation programs, including implementing innovations in customer metering, limiting unaccounted-for water, restricting outdoor sprinkling, implementing conservation water rates, expanding fixture rebate programs and educating in the public schools.²² However, Waukesha makes no attempt to quantify the impact of the vast majority of these programs, other than to say they will collectively reach the 1 mgd conservation goal. The only programs where attempts are made to quantify gains are those involving fixture rebates and the City Hall retrofit demonstration, which make up relatively insignificant pieces (less than 20%) of the overall projected savings in 2050.²³ Furthermore, even the programs that Waukesha has quantified warrant a careful look into the assumptions made. For example, Waukesha projects that approximately 63 mg in savings in 2050 will come from toilet replacements. Waukesha estimates savings of approximately fifteen thousand gallons per year for each toilet replacement.²⁴ The Public Service Commission's Summary of 2010 Water Utility Conservation Reports shows that Waukesha only saved approximately eight thousand gallons per toilet replacement, and that none of the seven utilities surveyed showed savings of more than 12,047 gallons per toilet replacement.²⁵ Even assuming that fifteen thousand gallons per toilet can be saved, this means that 4,200 toilets will need to be replaced. From 2008–2011, only eighty eight toilets were replaced in Waukesha, with a \$25 rebate.²⁶ While rebates will increase from \$25 to \$100 under Waukesha's plan,²⁷ WDNR should be careful to pressure-test any assumptions made by Waukesha.

²² CITY OF WAUKESHA, *supra* Note 7, at 5-7.

²³ CITY OF WAUKESHA, 3 CITY OF WAUKESHA WATER DIVERSION APPLICATION App. I (2013). Summing the projections for 2050 yields approximately 70 mg in savings, or less than 0.2 mgd.

²⁴ *Id.* at 1-4.

²⁵ PUB. SERV. COMM'N OF WIS., SUMMARY OF 2010 UTILITY WATER CONSERVATION REPORTS 6 tbl.2 (2010).

²⁶ NICHOLAS, *supra* Note 4, at 29.

²⁷ But note that Madison, a city three times Waukesha's size, saw all 2,500 of its available \$100 year 2010 toilet rebates awarded by October of that year. PUB. SERV. COMM'N OF WIS., *supra* Note 25, at 10. It is possible, but the assumptions must nevertheless be properly vetted.

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- 5.) Consideration of alternative sources: The Great Lakes Compact and the Wisconsin statutory scheme require that for a diversion to be approved, there must be “no reasonable water supply alternative within the watershed in which the community is located, including conservation of existing water supplies,”²⁸ and that Waukesha has “assessed other potential water sources for cost-effectiveness and environmental effects.”²⁹ The Cities Initiative is concerned about the cursory or inappropriate examination given to some alternatives, and the failure to consider others. Accordingly, the Cities Initiative urges WDNR to look closely at Waukesha’s alternatives analysis.

WDNR should satisfy itself that Waukesha was appropriate in making certain substantive judgments in evaluating alternatives. For example, Lake Michigan water is declared to pose a “minor risk” in terms of public health,³⁰ an assertion backed only on the grounds that “contamination is possible...but the large size, intake locations and high quality of Lake Michigan water makes this a rare occurrence.”³¹ This is a major reason that the Lake Michigan alternative is selected as preferred, but there is no substantive reason to believe that Lake Michigan is any more or less likely to face contamination than other water sources. Typically, aquifers are thought of as more protected water sources than open lake water, but the analysis of the aquifer alternatives gloss over this fact.³² WDNR should ensure that the same objective consideration is given to all alternatives.

Furthermore, the Cities Initiative is concerned about the failure to discuss alternatives that minimize the use of Lake Michigan water. While Waukesha has proposed one approach that does not take an “all or none” approach to using Lake Michigan water (the Lake Michigan / shallow aquifer alternative), Waukesha does not explore other such “Lake-other” hybrids. The Cities Initiative asks that WDNR satisfy itself as to Waukesha’s reasons for not exploring, for example, a Lake Michigan / deep unconfined aquifer combination, which would minimize withdrawals from Lake Michigan while still assuring the city of a reliable water source. Additionally, considerations of surface waters, including the Fox River (a

²⁸ WIS. STAT. § 281.346(4)(e)(1)(d) (2012).

²⁹ WIS. STAT. § 281.346(5m)(c) (2012).

³⁰ CITY OF WAUKESHA, *supra* Note 7, at 4-18.

³¹ *Id.* at 4-9.

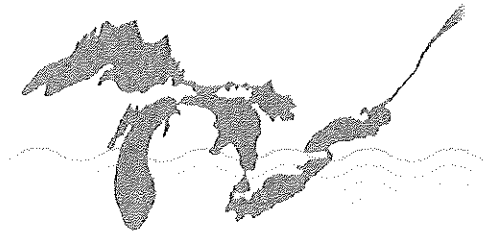
³² *See, e.g., id.* at 4-10 (“contaminants can pass quickly through sand and gravel aquifers”).

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source of water for 200,000-plus Illinois residents), are given short shrift.³³ Proper consideration of alternatives to Great Lakes water is at the very core of the Great Lakes Compact, and the Cities Initiative urges WDNR to carefully scrutinize Waukesha's compliance with the letter and the spirit of the law.

- 6.) Return flow considerations: The Great Lakes Compact and Wisconsin implementing statutes require the return of all diverted water, less consumptive use, to the Great Lakes basin, and that inflows of water from outside the Great Lakes basin be minimized.³⁴ The Cities Initiative asks WDNR to carefully examine Waukesha's submission for compliance in this area. While Waukesha touts the positive effects of discharging treated wastewater effluent into the Root River,³⁵ the Cities Initiative asks that WDNR carefully study the negative impacts that such discharges will have on the Root River. The Root River is prone to flooding, having recorded major floods in 2008 and 2010.³⁶ The addition of more water volume will only exacerbate the problem.

Additionally, as Waukesha recognizes, the Root River is already listed on the federal Clean Water Act's Section 303(d) "Impaired Waters" list for pollutants such as total suspended solids, total phosphorous and dissolved oxygen.³⁷ The Cities Initiative asks WDNR to carefully examine the consequences, both ecological and legal, of increasing discharges of pollutants to an already-impaired waterway.

We appreciate your review of the above comments and your close examination of the Waukesha application. The scrutiny given this application will set an important precedent for future diversion applications under the Great Lakes Compact. Please reach out with any questions that you might have about our concerns.

³³ FRIENDS OF THE FOX RIVER, STATE OF THE FOX RIVER REPORT 1 (2003), available at <http://prairierivers.org/wp-content/uploads/2007/09/statcoffoxriver2003.pdf>.

³⁴ WIS. STAT. §281.346 (2012).

³⁵ See, e.g., Behm, *supra* Note 1.

³⁶ Don Behm, *Waukesha's Root River Water Plan: Better Fishing or Worse Flooding?*, MILWAUKEE JOURNAL-SENTINEL (Nov. 14, 2013), <http://www.jsonline.com/news/waukesha/waukeshas-root-river-water-plan-better-fishing-or-worse-flooding-b99140148z1-231752221.html>.

³⁷ CITY OF WAUKESHA, 4 CITY OF WAUKESHA WATER DIVERSION APPLICATION § 3.2.7 (2013).

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Régis Lussanthe, President of Quebec Metropolitan Community, Vice Chair

John Dickert, Mayor of Racine, Secretary-Treasurer



Sincerely,

Keith P. Hobbs

Mayor Keith Hobbs, Thunder Bay, Canada
Chair – Great Lakes and St. Lawrence Cities Initiative

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John Dickert, Mayor of Racine, Secretary Treasurer

Lang, Kassandra M - DNR

From: Lang, Kassandra M - DNR
Sent: Monday, December 02, 2013 3:51 PM
To: DNR Waukesha Diversion App
Subject: FW: Great Lakes Coalition comments on Waukesha Diversion Proposal
Attachments: GL Coalition Waukesha Comments 12-2013.pdf; Waukesha Jim Nicholas Memorandum 12-2013.pdf; Waukesha Analysis Final.pdf

Categories: Red Category

From: Ebersberger, Eric K - DNR
Sent: Monday, December 02, 2013 11:09 AM
To: Lang, Kassandra M - DNR
Cc: Clayton, Nicole L - DNR; Fuchsteiner, Christopher J - DNR; Smail, Robert A - DNR
Subject: FW: Great Lakes Coalition comments on Waukesha Diversion Proposal

FYI

From: Marc Smith [<mailto:msmith@nwf.org>]
Sent: Monday, December 02, 2013 11:07 AM
To: Ebersberger, Eric K - DNR; Pfeiffer, Shaili M - DNR
Cc: dgerber@cleanwater.org; Katherine Nadeau; Kristen Kubitza; Jennifer McKay; James Clift; Nicole Barker; Jared Deutsch; Neil Kagan
Subject: Great Lakes Coalition comments on Waukesha Diversion Proposal

Eric,

In response to the WI DNR request for comments on the Waukesha Diversion application, please find attached comments from a coalition of Great Lakes conservation organizations re: the Waukesha Diversion proposal.

- 1) Comments
- 2) Memorandum from Jim Nicholas
- 3) Feb. 2013 report from NWF and Jim Nicholas

Thank you for your review and consideration. We look forward to working with you throughout your review process.

Best,
Marc

Marc Smith
Senior Policy Manager
National Wildlife Federation
734-887-7116 work
734-255-5413 cell

*Alliance for the Great Lakes – Clean Water Action, Minnesota - Environmental Advocates of
New York – Michigan Environmental Council - National Wildlife Federation
Ohio Environmental Council
Save the Dunes – Tip of the Mitt Watershed Council*

Secretary Cathy Stepp
Wisconsin Department of Natural Resources
101 S. Webster Street
Madison, Wisconsin 53707-7921

December 2, 2013

Eric Ebersberger
Wisconsin Department of Natural Resources
101 S. Webster Street
Madison, Wisconsin 53707-7921

Dear Secretary Stepp, and Mr. Ebersberger,

On behalf of the undersigned conservation organizations representing hundreds of thousands of people from across the Great Lakes Basin, we are writing to respond to the Wisconsin Department of Natural Resources (WI DNR) December 2, 2013, request for public comments concerning the City of Waukesha's proposed Water Diversion Application under the Great Lakes Compact.

As you know, the proposed Waukesha diversion application is the first since the Great Lakes Compact was adopted in 2008. This application may be a flashpoint for the Compact, establishing its effectiveness and serving as a precedent for other subsequent diversion proposals. The Compact is clear on what is expected of any diversion application. First, any diversion proposal must exhaust all options available and in essence be a last resort, and second, a clear need for water must exist. However, even after Waukesha submitted additional information to WI DNR, many outstanding questions remain on its demand forecast, feasible water supply alternatives, return flow, and the WI DNR's requirement that Waukesha include other areas in Waukesha county in a 'extended service area' as part of its application.

Specifically, we have the following questions regarding the application:

Demand Forecast

We acknowledge that Waukesha has a sustainable water source problem. Naturally occurring radium has infiltrated its drinking water source, thus creating a public health issue. However, after reviewing the new information submitted by Waukesha, we maintain that it might not need to divert Great Lakes water to meet its water needs. In a National Wildlife Federation report authored in February of 2013 by Jim Nicholas, a scientist and retired director of the U.S. Geological Survey's Michigan Water Science Center, Waukesha's demand for water has been decreasing since the late 1980s. However, in the current application, the city projects a much higher demand that is inconsistent with historical trends. While the new information submitted by Waukesha reduces the overall demand, it still does

not justify why it needs so much water. We ask that more information be provided by Waukesha that demonstrates this higher demand forecast.

Feasible Water Supply Alternatives

Over the last couple years, regional groundwater levels in Southeast Wisconsin are stabilizing or rising. Again, based upon NWF's report referenced above, we maintain that potential alternatives may exist that could provide some of Waukesha's future water needs. Some could meet all, depending on how much water is actually needed. The Great Lakes Compact requires in Section 4.9.3.d that "There is no reasonable water supply alternative within the basin in which the community is located, including conservation of existing water supplies." Given this Compact requirement, Waukesha does not thoroughly demonstrate that no current or alternative sources exist that may be feasible to meet existing and future demands. This lack of information opens up questions over whether or not a Lake Michigan diversion is necessary.

Return Flow

The application indicates that Waukesha will return its water, less consumptive use, to the Great Lakes Basin via the Root River. It is unclear from the language in the application that if— during major storm events — some percentage of water would be kept in storage and then returned via the Fox River, which is in the Mississippi River Basin. The Compact is clear that all water, less consumptive use, be returned to the Great Lakes Basin. This scenario raises questions about water co-mingling from different watersheds, returning to different watersheds, and thus complying with the Exception Standard in the Compact.

Extended Service Area

Waukesha is eligible to apply for Great Lakes water because it lies within a county that straddles the Great Lakes and Mississippi River divide. However, the application includes towns in Waukesha County (Pewaukee and the Towns of Delafield and Waukesha, among others) that may not need water. To date, none of the communities in the extended service area has demonstrated that it is without adequate supplies of safe drinking water. Some officials in these areas have indicated that they do not need any water either now or in the foreseeable future. Including this in the application is again in direct contrast to Section 4.9.3.d of the Compact. While Wisconsin statutes may dictate that Waukesha include these areas as part of its application, the Great Lakes Compact is clear that a need for water must exist in the community for it to be eligible for a diversion. If these areas are to be included as part of the application, they need to demonstrate that they meet all requirements of the Great Lakes Compact before the application is finalized.

Please also find attached a memo from Jim Nicholas, who after reviewing the new information submitted by Waukesha, reaffirms that the new information in the Waukesha application does not change his original findings in his February 2013 report.

In closing, we appreciate your consideration of our comments. We intend to submit more substantial comments as part of your formal review process. We value the WI DNR's commitment to a thorough and robust EIS process and technical review. We look forward to working with you throughout this process.

Sincerely,

Marc Smith
Senior Policy Manager
National Wildlife Federation

Katherine Nadeau
Policy Director
Environmental Advocates of New York

Nicole Barker
Executive Director
Save the Dunes (IN)

Darrell Gerber
Program Coordinator
Clean Water Action – Minnesota

James Clift
Policy Director
Michigan Environmental Council

Jennifer McKay
Policy Specialist
Tip of the Mitt Watershed Council (MI)

Kristen Kubitza
Director of Water Policy & Outreach
Ohio Environmental Council

Jared Teutsch
Water Policy Advocate
Alliance for the Great Lakes

Memorandum

To: Marc Smith, National Wildlife Federation
From: Jim Nicholas, nicholas-h2o
Date: November 25, 2013
Subject: Brief review of new Waukesha application for a diversion from Lake Michigan

This memo is in response to your request that I review the parts of the subject application regarding demand forecast and alternative sources of water supply. This review is done with the intent of determining if there are substantive differences between the new application and the previous one I reviewed in February 2013. I spent most of my time on (1) the updated demand forecast and (2) the arguments against using the several alternative sources of water supply. These topics are covered in Volumes 1, 2 and 5 of the application. I did not review any revisions to groundwater flow modeling. My understanding is that technical comments on groundwater flow modeling are being provided to DNR from other qualified hydrogeologists familiar with the modeling.

Regarding the average-day demand forecasting, the approach is similar to the original application. There is no substantive change to the demand forecasting model for average day demand. The demand is forecast using a value of gallons per capita per day (GPCD) that is an average from the last 10 years. Since the last 10 years (and the last few decades) show a clear decreasing trend in GPCD, using an average value to predict future demand is inappropriate. As noted in my previous analysis, a forecast model should be able to explain why and when the historical decline in GPCD will stop and why there will be a subsequent increase in GPCD, especially given the implementation of planned conservation and efficiency measures (CEMs). Additionally, the forecast model should be able to backcast, that is, if applied to historical data a forecast model should be able to calculate historical water use reasonably well.

Regarding maximum-day demand forecasting, the approach used is identical to the original application. The approach uses a ratio of maximum-day to average-day demand of 1.68. This is the same ratio used in the original application. As noted in my previous review, this ratio has been exceeded only once since 1970 and that was in 1992. Maximum-day demand in Waukesha is typically caused by hot/dry weather, according to reports to the Public Service Commission of Wisconsin and many of Waukesha's CEMs are focused on reducing demand related to hot/dry weather. Therefore, a ratio reflecting recent history and implementation of CEMs should be used.

Regarding evaluation of water-supply alternatives, summarized in Volume 1, Exhibit 4-18, the new application is similar to the original. All alternative groundwater supplies are concluded to cause significant adverse environmental impacts, are not sustainable, and are not protective of public health. However, these conclusions are all questioned in my previous analysis and no substantive new rationale has been presented that alters my previous conclusions. If one extended the applications approach to all groundwater supplies in Wisconsin, most of Wisconsin's public water supplies would cause adverse environmental impacts, be unsustainable, and not protect public health.

Regarding water-supply alternatives, reasonable use of water, and the Compact decision-making standard, summarized in Volume 1, Exhibit 4-20, the new application is similar to the original. The conclusion in the application is that only use of Lake Michigan would comply with the Compact. However, this conclusion is based on two sets of arguments that are questionable. The first set is that all groundwater sources cause significant adverse resource impacts, are unsustainable, and are not protective of health. The lack of rigor of these arguments is noted in the above paragraph. The second set of arguments is based on assumptions and misunderstanding of issues I outlined in my February 2013 report (pp.15-18). The most notable misunderstanding is that any groundwater use has a significant adverse impact on Waters of the Great Lakes Basin; any impact is trivial and has not been directly tied to Waukesha's alternative groundwater sources. Another is that stopping pumping of groundwater in the deep sandstone aquifer will restore hydrological and ecological functions to Waters of the Great Lakes Basin; any impact of pumping cessation would be trivial. A third is the confusing argument about returning water to its Source watershed. The first row of Exhibit 4-20 should state that "All water is returned to source" for every column, not just for the Lake Michigan alternative. Below I have excerpted two paragraphs from my February 2013 analysis that speak to the above issues:

The second are issues related to the effect of groundwater withdrawals on Waters of the Great Lakes Basin. By Compact definition, none of the groundwater sources considered by the Application are Waters of the Great Lakes Basin. Stopping deep confined aquifer pumping in Waukesha will not improve the Waters of the Great Lakes Basin; continued pumping in Waukesha will not impair Waters of the Great Lakes Basin. Regionally in southeast Wisconsin pumpage from the deep confined aquifer does result in a small amount of inducement of flow from Lake Michigan (1.33 Mgd in the SEWRPC model for 2000) and a small amount of capture of water that would have flowed to Lake Michigan (2.67 Mgd) and an unknown amount of streamflow capture and inducement within the Great Lakes Basin (not reported separately by watershed for SEWRPC model, though the total from inside and outside the Great Lakes Basin was 19.7 Mgd). Besides having small or unknown impacts on Waters of the Great Lakes Basin, there has been no study to indicate how changes in only Waukesha's pumping, using updated pumping in the area, will affect flow of groundwater to Lake Michigan or to streams tributary to Lake Michigan. Without knowing the impacts of continued or no pumpage from the deep confined aquifers, there is nothing to say about the environmental impacts on Waters of the Great Lakes Basin.

The third issue is the Application's evaluation of how uses of various sources will or will not meet Compact requirements (Application exhibit 4-20). This exhibit treats the deep confined and shallow aquifer sources in Waukesha as Waters of the Basin, which they are not. The Compact sections referenced in the first column of exhibit 4-20 refer only to Source watershed and water sources that are parts of Waters of the Great Lakes Basin. They do not apply to other water sources in Wisconsin. Therefore the final two columns in exhibit 4-20 are not relevant to Compact requirements and should be filled in with "NA—not applicable". The Application's line of reasoning in this regard is illustrated by the following statement from Appendix D, p. 31 (and quoted in the Application):

One of the decision making standards of the Compact (4.11.1) states "All Water withdrawn shall be returned, either naturally or after use to the Source watershed less allowance for Consumptive Use." Since the deep aquifer and the waters of the Lake Michigan Basin are hydrologically connected, pumping the deep aquifer and discharging the water into the Fox River does not comply with this Compact decision-making standard.

In fact, the Compact states that groundwater outside of the watershed boundary of the Great Lakes is not in any of the Source Watersheds of the Great Lakes Basin. Thus the Compact Decision-Making Standard is not relevant to Waukesha's return of wastewater from groundwater sources to the Fox River.

An Analysis of the City of Waukesha Diversion Application

Focusing on Conservation and Efficiency Measures,
Demand Forecast, and Alternative Sources of Water Supply

Jim Nicholas
February 2013

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Introduction

This paper presents an analysis of certain aspects of the City of Waukesha's Water Diversion Application (Application). The Application was submitted to Wisconsin DNR (WDNR) in May 2010. In addition to the Application, numerous other documents were submitted or referred to. Many of these are at WDNR's City of Waukesha Water Diversion Application web page. Documents reviewed in part or in whole are listed at the end of this paper.

The scope of this paper is limited to three aspects of the Application: conservation and efficiency measures, demand forecast, and sources of water supply. For sources the focus is on hydrologic and environmental aspects of withdrawals in the Application. Issues related to economic factors and return flows to Lake Michigan, for instance, are not addressed. The author assumes readers are familiar with the Application and related documents, so material from documents is not presented again in this paper; rather it is referred to and is described only to provide insight into analyses.

The goal of this paper is to provide an objective scientific analysis of particular aspects of the Application. The author is a scientist and an experienced hydrologist. He is neither an opponent nor a proponent of the Application. This paper contains no recommendations for actions by any parties.

The Application is for water to meet the needs of a service area that is not congruent with the City of Waukesha's current utility. Information in the Application regarding water sources, conservation measures, and demand is not presented separately for the parts of the service area outside of the City of Waukesha. Therefore, this paper assumes that facts and figures presented, in the Application and associated documents, are for the service area, unless documents specify otherwise. Where this paper refers to Waukesha water conservation measures, demand forecasts, and water sources, "Waukesha" refers to the service area for which the Application was made.

Water Conservation and Efficiency Measures

This section describes Waukesha's water conservation and efficiency measures (CEMs). It summarizes which CEMs have been implemented, which are still planned, and water savings for each, if available.

Regardless of the source of Waukesha's future water supply, water conservation is an essential part of the City's long-term strategy to meet future demands. Waukesha adopted a Water Conservation and Protection Plan in 2006 and updated it in 2012 as the Final Water Conservation Plan (FWCP). This plan describes water conservation and implementation strategies for all use sectors. The program will be evaluated annually and formally updated in 2016.

The FWCP sets a goal of 10 percent savings in water demand by 2050, based on the 2050 average day demand projection of 10.9 Mgd. Interim goals are savings of 0.2 Mgd by 2016 and 0.5 Mgd by 2030, with a final goal of 1.0 Mgd by 2050.

The principal CEMs are focused on 5 areas:

- Monitoring unaccounted for water and focusing on leak detection and repair;
- Promoting water conservation through public information and education campaigns;
- Replacing high-use fixtures by providing users with financial incentives;
- Reducing lawn sprinkling through ordinances; and
- Reducing average day and maximum day demand using inclining water rate block structures.

No specific water conservation targets are set for each CEM, except for fixture replacement. Rather they collectively are expected to meet the goals for 2016, 2030, and 2050.

Implemented CEMs

Unaccounted for water CEM—Waukesha has fairly low percentage of unaccounted for water, about 6 percent, with some variability from year to year. This is well below the average of 18 percent for large municipal systems in Wisconsin reported in Water Efficiency Potential Study (WEPS) for Wisconsin. It is also below AWWA's recommended 10 percent. Waukesha continues its leak detection and repair program, as well as auditing that can point to unaccounted for water. No specific amount of conserved water is associated with this CEM, because unaccounted for water continues to hover around 6 percent and is expected to do so in the future.

Public information and education CEM— According to WEPS, EPA estimates a 3 to 5 percent reduction in water use as a result of information and education programs. Waukesha has promoted conservation through a variety of media and methods. In 2011, Waukesha spent \$16,545 on these efforts, according to their Report on Water Conservation Programs to the Public Service Commission of Wisconsin (PSC). Although no specific amount of conserved water is associated with this CEM, it is a critical part of ensuring success in rebate programs, outdoor watering, inclining water rate block structures, and reducing overall demand.

Fixture replacement rebate CEM—Waukesha launched a toilet rebate program in October 2008, with a goal stated in the Application of saving 0.5 Mgd by 2050. From inception through 2011, the program has resulted in replacements of 88 toilets at a cost of \$25 per toilet. According to the Report on Water Conservation Programs the savings over this time period was 1,430,825 gallons or 0.001 Mgd. Waukesha estimates a savings of 15,000 gallons per year per toilet in the Application. Thus to reach the 2050 goal of 0.5 Mgd savings, the total number of toilets that would need to be replaced is a little over 12,000 or 300 per year between 2011 and 2050. Possibly the Application meant to refer to replacement of other fixtures besides toilets, because

the FWCP sets a goal of 7,444,000 gallons saved over 5 years (2112-2016), which equates to about 99 toilets per year.

The PSC's Summary of 2010 Utility Water Conservation Reports is a summary of water conservation efforts for eight utilities required to report these to the PSC. The number of toilet rebates for these utilities ranged from 14 to 2504, the latter for a city three times bigger than Waukesha (table 1). Waukesha had 17 toilet rebates. The amount of water saved per rebate was quite variable, ranging from 2000 to 12,000 gallons per year. Waukesha's was 8000 gallons per year. This is significantly less than, nearly half, the amount Waukesha estimated to save in the Application, which was 15,000 gallons per year per toilet. Thus, there is some uncertainty with respect to projections of water savings from the toilet rebate program.

Reported Water Savings from Toilet Rebate Programs in Wisconsin (CY 2010)				
Utility	Number of Toilet Rebates	Estimated Water Savings (Gallons)	Estimated Water Savings per Rebate (Gallons)	Estimated Water Savings (Mgd)
Janesville Water Utility	104	335,809	3,229	0.0009
Kaukauna Water Utility	95	1,144,440	12,047	0.003
Madison Water Utility	2,504	18,345,151	7,326	0.05
Marshfield Utilities	54	108,000	2,000	0.0003
New Berlin Water Utility	77	820,000	10,649	0.002
Sun Prairie Utilities	14	34,829	2,488	0.0001
Waukesha Water Utility	17	137,064	8,063	0.0004
Total	2,865	20,925,293	7,304	0.0567

Source: Table 2 in 2010 PSC Conservation Summary.

Table 1. Reported water savings from toilet rebate programs in 2010 for eight water utilities in Wisconsin.

According to WEPS, toilets account for nearly 30 percent of indoor water consumption. Average residential single-family water use per household is 30 GPD for a toilet. Based on 2010 Census data on the year homes were built, 85 percent of residential customers in Wisconsin are estimated to have 3.5 gallons per flush (gpf) toilets, 13 percent have 1.6 gpf, and 2 percent have 1.28 gpf toilets. The distribution in Waukesha has not been estimated.

Outdoor watering ordinance CEM—Waukesha implemented outdoor sprinkling restrictions for all customer classes in 2006. According to Waukesha's 2010 Water Conservation report to the PSC, the restrictions are applicable from May 1 to October 1. The restrictions ban daytime sprinkling from 9:00 a.m. to 5:00 p.m. Customers are allowed to irrigate two days a week

according to their address. According to WEPS, inefficient irrigation practices can cause observed water loss of 20 to 50 percent of outdoor water use.

In 2010, maximum day demand was 8.65 Mgd, which is 67 percent lower than the 2005 peak demand of 12.87. For the same time period, the difference in average day to maximum day demand decreased 61 percent. Although other factors affect maximum day demand, the sprinkling ordinance is likely a major factor in reducing it.

Inclining water rate block structures CEM—In 2007, Waukesha was the first city in Wisconsin to adopt an inclining water rate block structure. The structure is applicable to residential users. It sets different costs (or rates) for water according to the amount of use. Rate blocks are associated with different levels of quarterly use (for example, 0 to 10,000 gallons, 10,001 to 30,000 gallons, and over 30,001 gallons). Costs in the highest rate block are 40 percent higher than in the lowest rate block. The idea is to provide a price incentive for customers to use less water.

Since implementation of the inclining water rate block structure, residential water use has decreased. Over the same time period, water use has declined in the industrial, commercial, and public water use sectors also, so factors other than the inclining water rate block structure are likely causing a decline in water use in the residential sector. Still price incentives have been shown to significantly reduce water use, although adjustments in the number of rate blocks, the amounts of water associated with each, and the cost of water in each sometimes take several years to achieve desired results. Timely feedback (billing) to customers is also necessary so that decisions on use can be made. Monthly billing would likely influence water-use decisions more effectively than does quarterly billing. According to WEPS, EPA estimates that an inclining block rate structure can lead to a 5 percent overall reduction in water use.

Planned CEMs 2012 to 2016

Waukesha's current implementation strategy, outlined in the FWCP, is designed to develop a foundation for the programs in Year 1 (2012) through public education and incentives for residential customers, particularly the top 10 percent water users. Starting in Year 2 (2013), the program focus would expand to include incentives for commercial and industrial customers. As the program expands over the subsequent three years (2014 to 2016), additional measures would be emphasized to capture the greatest savings and the lowest costs. This plan is outlined in Table 8-5 in the FWCP.

Table 2, adapted from Table 8-1 in the FWCP, shows a projected 86 MG (0.24 Mgd) in water savings across all sectors in millions of gallons per year between 2007 and 2016. Waukesha's implementation schedule is outlined only until 2016, leaving some uncertainty about how the additional 0.26 Mgd in savings will be achieved by 2030. Furthermore, how Waukesha will achieve an additional 0.5 Mgd between 2030 and 2050 has not been described. That being said, plans need to remain flexible in order to be effectively budgeted and implemented. When the

Conservation Plan is reviewed again in 2016, Waukesha should know what its future water supplies will be and can better evaluate and adopt appropriate measures.

Total Projected Cumulative Water Savings										
User	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Residential	6.1	12	17.7	23	28.1	35.4	43.2	51	59.1	67
Commercial, Industrial, & Public	1.8	3.6	5.2	6.8	8.3	9.8	12.1	14.3	16.6	19.7
Total (Mgy)	7.9	15.5	22.9	29.8	36.4	45.2	55.3	65.4	75.8	86.8
Total (Mgd)	0.02	0.04	0.06	0.08	0.1	0.12	0.15	0.17	0.21	0.24

Table 2. Projected Waukesha water savings 2007-2016.

Unaccounted for Water CEM – As previously stated, unaccounted for water is relatively low in Waukesha. Waukesha will continue its leak detection and repair programs and water audits.

Public Information and Education CEM – Current measures already implemented will be further publicized and expanded in scope through 2016. Educational programs will expand into schools, from elementary to college campuses, such as Teach the Teacher workshops and course projects. Partnerships with coalitions throughout Waukesha County will strengthen and expand as well. Although this CEM is an essential part of any water conservation plan, no specific goal of water savings is associated with it.

Fixture Replacement Rebate CEM – Measures incentivizing fixture replacement will be expanded from 2012 to 2016 as well. For residential customers, the toilet rebate program will provide \$100 rebates, rather than the current \$25, with the objective of accelerating the number of replacements. Rebates or a distribution program will also begin for high-efficiency showerheads. Indoor water audits will also be available to residential customers. As shown in Table 3, the projected water savings from these measures are 8.34 MG (0.0046 Mgd).

For commercial, industrial, and institutional customers, rebates for high-efficiency toilets, showerheads, clothes washers, spray-rinse valves, and urinals will begin in order to provide incentives for these customers to make their facilities more efficient. Indoor water use audits will also begin for these use sectors between 2012 and 2016. According to WEPS, residential and nonresidential audits that include plumbing retrofits, evaluations of kitchen and irrigation systems, and leak reduction have the potential to reduce demand by 15 to 35 percent. Based on only the CII water demand from 2008-2010 in the FWCP, that would equate to 0.0009 to 0.0022 Mgd in water savings. As shown in Table 3, according to the FWCP an estimated 4.93 MG (0.0027 Mgd) in water savings is attributed to these programs.

Projected Water Savings 2012-2016			
User	Conservation Measure	Projected Water Savings (MG)	Projected Water Savings (Mgd)
Commercial, Industrial, and Public	High-Efficiency Toilet Rebate	0.41	
	Water-Efficient Showerhead	0.04	
	Indoor Water Use Survey	0.06	
	Outdoor Water Use Survey	-0.11	
	Urinal Rebate	0.28	
	Spray-Rinse Valves Rebate	4.24	
	High-Efficiency Clothes Washer Rebate	0.01	
		4.93	0.0027
Residential	High-Efficiency Toilet Rebate	7.44	
	Water-Efficient Showerhead	0.88	
	Indoor Water Use Survey	0.08	
		8.39	0.0046
Total		13.32	0.007

Source: Table 6-6 in FWCP

Table 3. Projected Waukesha water savings in millions of gallons for various fixtures, 2012-2016.

Outdoor Watering Ordinance CEM – The sprinkler ordinance will remain in effect through 2016 to continue to help reduce average and maximum day demand in summer months.

Inclining Water Rate Block Structure CEM - Water pricing is an important driver of a comprehensive conservation program. The current rate structure will continue to be evaluated annually.

Recommended Future CEMs in FWCP post-2016

A detailed outline of Waukesha's long-term implementation strategy is available in Appendix F of the FWCP. As many of these measures are continued or expanded versions of measures already implemented, proper tracking and evaluation over the next few years is essential in allowing stakeholders to better project water savings for the following measures.

Unaccounted for Water CEM – Leak detection and repair programs will continue post-2016. A new policy regarding the survey and repair of leaks upon the sale or lease of property may also come into affect.

Public Information and Education CEM – This CEM is planned to continue.

Fixture Replacement Rebate CEM - There are many areas within each use sector that Waukesha can, and in some cases already is, exploring for water savings through rebates. For example, one area that appears to have a high potential for water savings is addressing inefficiencies of cooling systems through audits and retrofits. According to WEPS, cooling systems account for 16.8 percent of indoor water use in nonresidential accounts. Irrigation technology or spinkler head replacement rebates are also being considered. A new policy requiring plumbing retrofits upon sale or lease of property may also come into effect. Furthermore, incentives or policies

regarding water-efficiency standards for new buildings and low-impact development techniques are likely to begin.

Outdoor Watering Ordinance CEM – The sprinkler ordinance will continue to remain in effect. Irrigation control outreach, along with distribution of rain gauges or sensors to high water users with either large lots or high peak seasonal use will also be explored. New efficiency standards addressing outdoor decorative features and swimming pools may also be implemented.

Inclining Water Rate Block Structure CEM – The current rate structure will continue to be evaluated annually. Waukesha will also explore monthly billing which has been shown to increase customer awareness about water use and thus decrease demand.

Comparison to other cities

The EPA recently published a report that highlights the results of water conservation plans implemented by different cities around the country. As shown in Table 4, water savings from conservation plans that incorporate elements similar to Waukesha's ranged from 7.3 to 30 percent. Obviously, differences in climate, population, infrastructure, water savings potential, and user profiles exist between these cities and Waukesha. However, it does provide insight as to the level of water savings a city can hope to achieve following implementation of a comprehensive water conservation plan. The amount of water savings these cities achieved show that Waukesha's goal of a 10 percent reduction in average day demand is reasonable and may be conservative.

Water Conservation Case Studies		
City	Approach	Results
Houston, TX	Education Program, Plumbing Retrofits, Audits, Leak Detection and Repair, Increasing-Block Rate Structure, and Conservation Planning.	Estimated 7.3% reduction in water demand by 2006.
Goleta, CA	Plumbing Retrofits and Increased Rates.	30% decrease in district water use. 50% reduction in per-capita residential water use.
Irvine Ranch Water District, CA	Five-Tiered Rate Structure.	19% decrease in water use in the first year.
Cary, NC	Education Program, Toilet Rebates, Landscape and Irrigation Codes, and Rate Structure.	Water savings of 16% by 2028.
Santa Monica, CA	Education Program, Water Use Surveys, Toilet Retrofits, and Landscaping Measures.	14% reduction in water use.
Seattle, WA	Education Program, Plumbing Retrofits and Code, Seasonal Rate Structure, and Leak Detection and Repair.	20% drop in per capita water use in the 1990s.
Tampa, FL	Education Program, Plumbing Retrofits, Increasing-Block Rate Structure, and Irrigation and Landscape Codes.	Pilot retrofit program achieved 15% reduction in water use.

Source: USEPA Cases in Water Conservation.

Table 4. Results of water conservation case studies for eight North American cities.

Effect on average day demand and maximum day demand

Waukesha's plans for conservation and efficiency measures are to reduce average day demand by 10 percent. Maximum day demand, while important, is only the demand for a single day and can be affected by activities that are not impacted by conservation, such as firefighting. Maximum day demand is important mostly for design and infrastructure, and less so for

environmental impacts of withdrawals. A better target might be reducing maximum week or month demand. Measures related to outdoor water and cooling will reduce maximum day demand, but more importantly, they will reduce maximum week or month demand.

FWCP 4.2.3 makes the argument that demand will increase due to improving economic conditions, especially growth in the commercial and industrial sectors. While it appears reasonable to argue that an increase in water utility customers will result in higher demand, the history of demand and per capita use by sector does not support this argument, as discussed in the next section on Demand Forecast.

If the FWCP is fully implemented and successful, then per capita demand and maximum day demand should continue to decrease. It is difficult, however, to directly measure progress towards the conservation goal for individual CEMs, other than fixture replacement, because there are many confounding factors that affect trends in demand. Demand and water use per capita were decreasing for a long time prior to implementation of CEMs, as shown in the next section. Estimates of savings for each CEM could be made, as they are, for example in WEPS.

Water Demand Forecasts

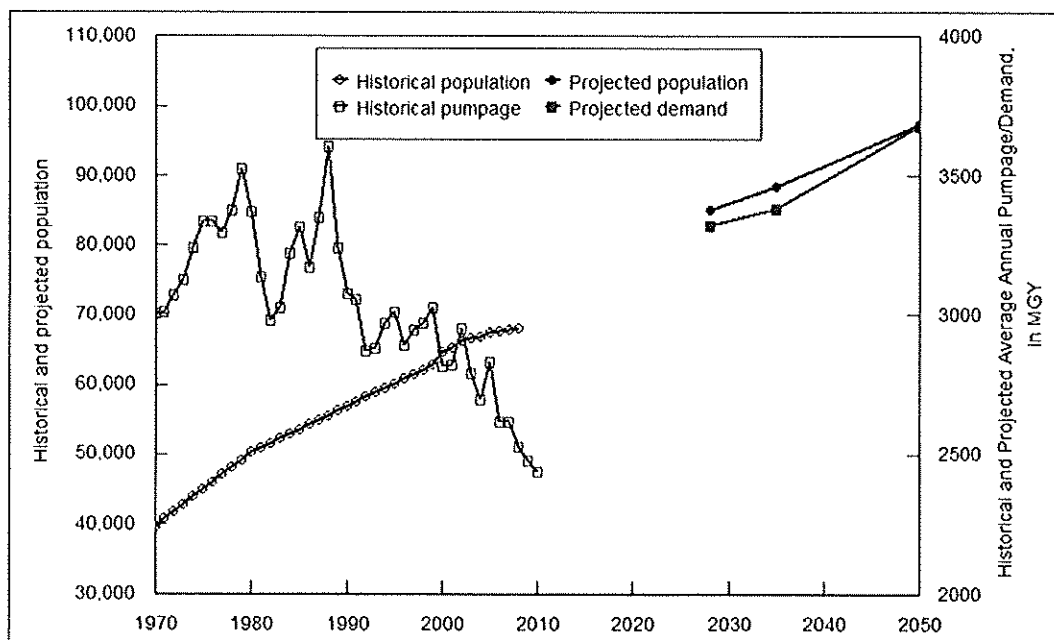
Future water needs are based upon projections of population growth, a future mix of water-use sectors (residential, commercial, industrial, and public), estimates of the amount each sector will use, and improvements and efficiencies in infrastructure and water use that conserve water. Estimates of future water needs are conservative in the sense that they must not under-predict future needs. Potential and largely unpredictable changes in infrastructure, demand, and climate must all be accounted for.

Waukesha forecasts water needs for 2050. The Application assumes that 2050 represents a timeframe in which the population and associated use sectors have reached their maximum based upon planning studies done by the City of Waukesha and SEWRPC. There are projections in various other documents for timeframes before 2050, such as SEWRPC's 2035 projections. However, the Application is conservative in the sense that it applies for water needs in "ultimate" buildout and water use for Waukesha.

Water demand forecasts, through the use of future population and water use estimates, project needs for water in the future. The Waukesha Diversion Application includes several documents that contain water demand forecasts or information relevant to forecasts. These were reviewed for this analysis and include: Appendix C—Future Water Supply (March 2002), Appendix K—Summary of Water Requirements, (May 2009), Appendix D—Water Supply Service Area Plan (April 2010), the Application (May 2010), and Final Water Conservation Plan (May 2012).

The most recent demand forecasts for 2050 are an average day demand of 10.9 million gallons per day (Mgd) and a maximum day demand of 18.5 Mgd (Appendix D, exhibit 13). The average day demand projected for 2050 assumes a constant gallons per capita per day (GPCD) from 2008 through 2050 for three use sectors (residential, commercial and public) that is near, but above, current GPCD (Appendix D, exhibit 13). GPCD is not given specifically for the industrial sector, but instead a total water use for 2050 is given (Appendix D, exhibit 13). Future average day demand is forecast simply by using a static GPCD of 112 and future population estimates, along with assumptions on unaccounted for water and a percent reduction in demand from implementing CEMs. Future maximum day demand is based on a ratio of maximum day demand to average day demand of 1.68 (Appendix D, p. 16), using analyses of historical ratios and precautionary assumptions regarding factors that may increase maximum day demand, such as extended drought (Appendix D, p. 16).

Figure 1 illustrates the historical trends in population and pumpage, along with projected population and demand. Note that both the historical and projected population have increasing trends. In contrast, Historical pumpage has a decreasing trend, and projected demand has an increasing trend.



Historical data through 2008 from App K, table 1, 2009-10 from Final Water Conservation Plan, figure 4-1. Projected 2028 data values from App K, table 5. Projected 2035 and 2050 values from App D, exhibits 11 and 13.

Figure 1—Historical and projected water demand and population for Waukesha.

Illustrating similar trends to Figure 1, Figure 2 shows historical declines in GPCD, average day pumpage, and maximum day pumpage, while showing increases in projected values for all three of these.

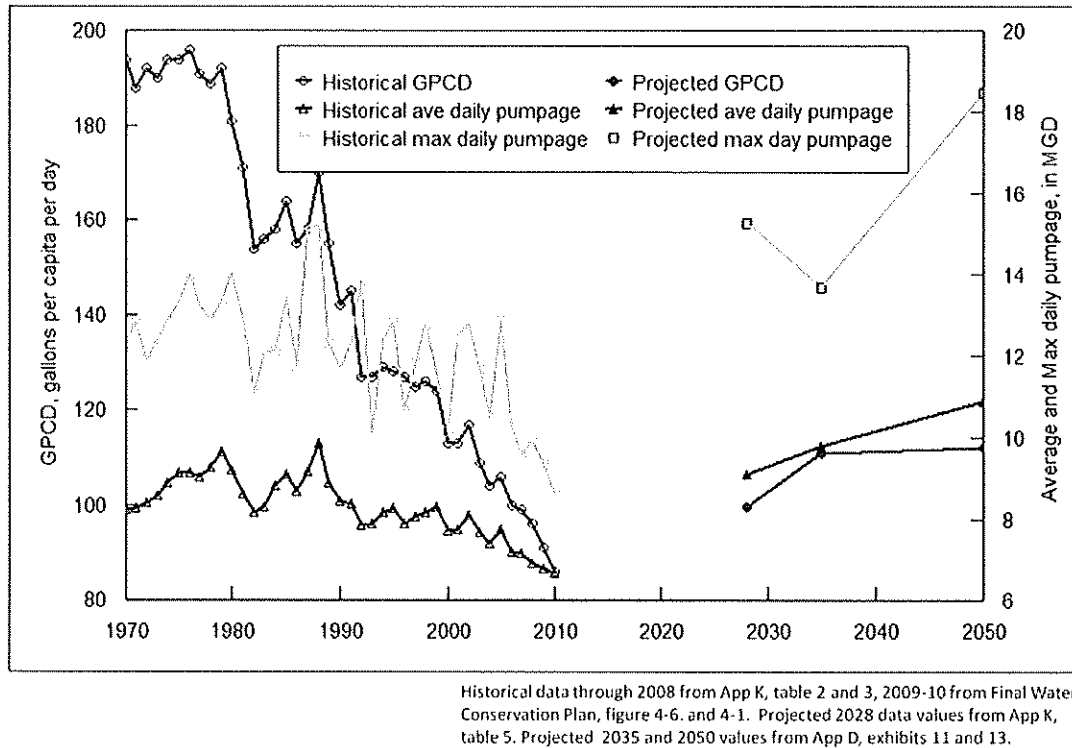
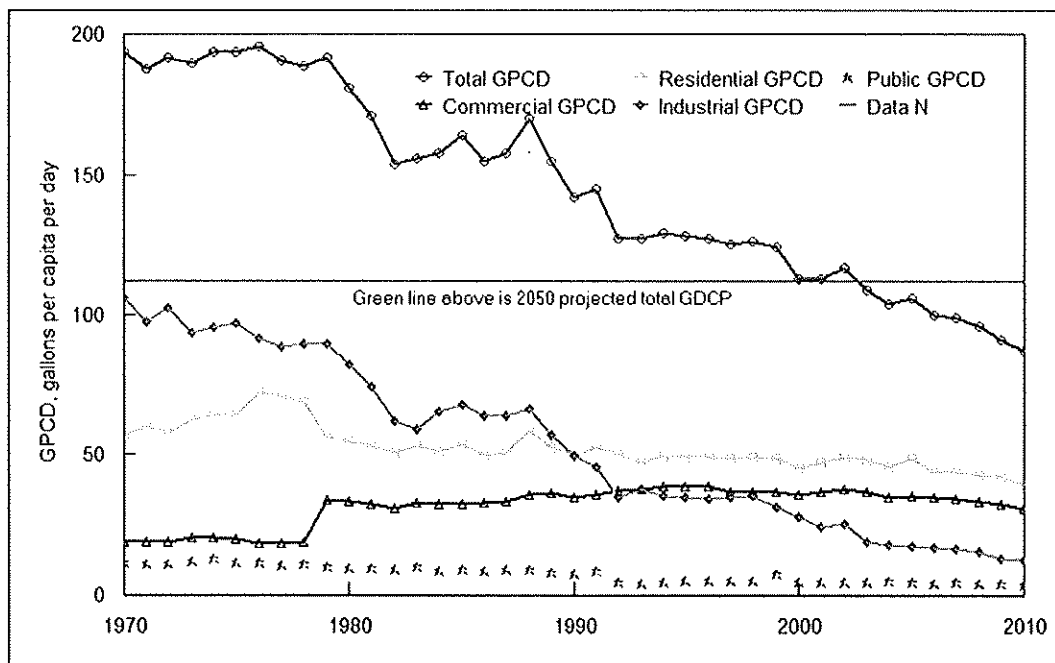


Figure 2—Historical and projected GPCD, average and maximum day demand for Waukesha.

Figure 3 shows trends in GPCD for various use sectors and total GPCD. Aside from the commercial use sector, other use sector GPCDs and total GPCD show historical declines. The horizontal line indicates the total GPCD, 112, which is used to project 2050 average day demand (Appendix D, exhibit 13). In comparison, the total GPCD for 2010 was 86.



Historical GDCP through 2008 from App K, table 2, 2009-10 from Final Water Conservation Plan, figure 4-6. 2050 GDCP is from App D, exhibit 13.

Figure 3—Historical GPCD compared to projected GPCD for Waukesha.

Future maximum day demand is projected by using a ratio of 1.68, based on historical ratios of maximum day demand to average day demand. Figure 4 shows the historical ratios. No trend is apparent. The average ratio is 1.46, and only thirteen years from 1970 to 2010 had ratios above 1.5. The most recent ratio for 2010 is 1.30. The horizontal line illustrates the ratio used for projection of 2050 maximum day demand. Only one year, 1992, has a value equal to or greater than 1.68.

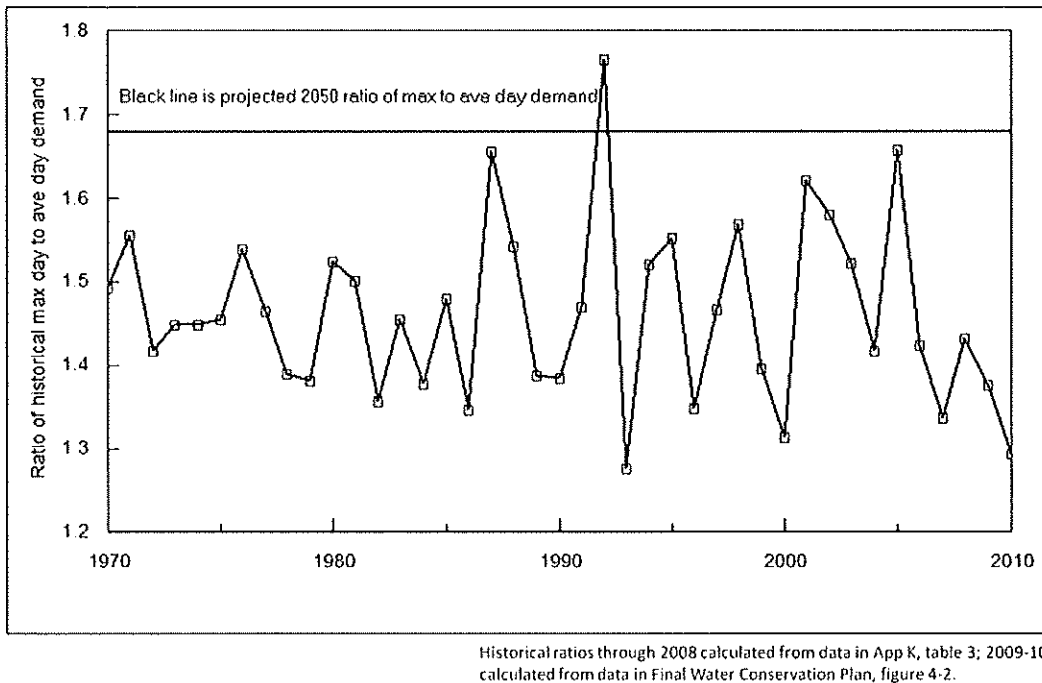
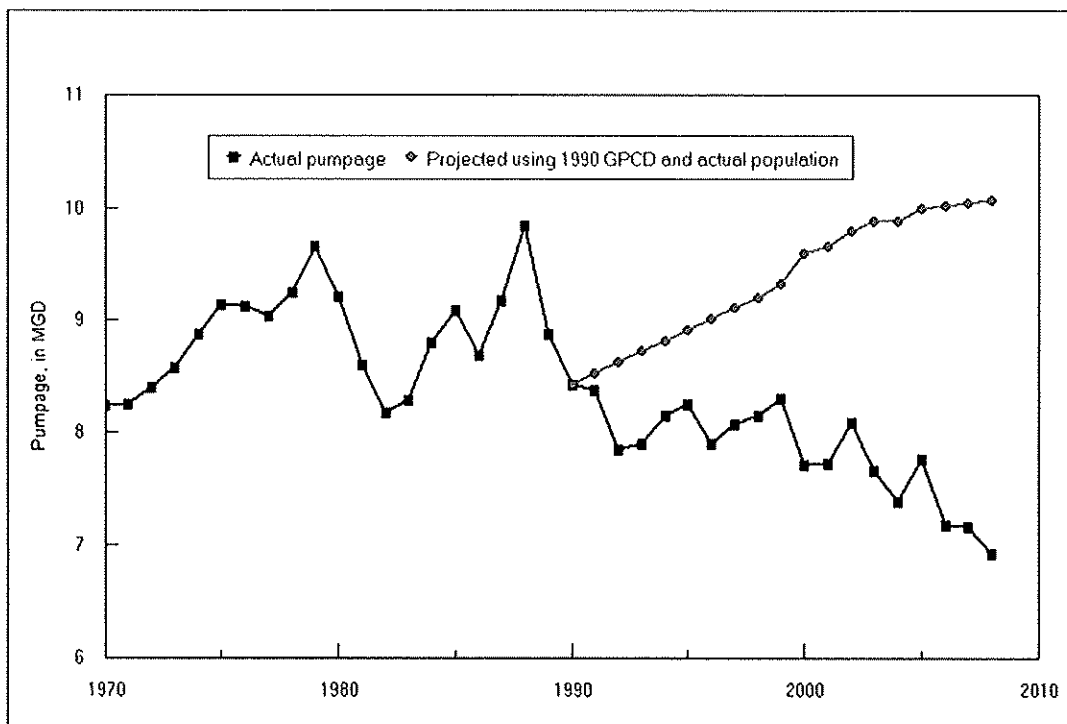


Figure 4—Historical ratio of maximum to average day demand compared to projected for Waukesha.

Models of any kind that predict the future typically are calibrated to historical data. Doing so gives confidence that predictions are based on known historical relationships and functions. The demand forecast model used for Waukesha does not appear consistent with historical data; that is, it cannot predict historical data, as illustrated in this paragraph and Figure 5. The model used to forecast average day demand assumes a constant GPCD of 112, similar to that in 2000. Using a similar approach, one can test the predictive capabilities of the model by using the historical GPCD of 1990 (142), predict future demand, and compare it to historical average day pumpage from 1991 to 2008. The results of this test of the predictive model are shown below in Figure 5. Clearly, the further in time one moves from the base date of 1990, the more the model over-predicts demand.



Data from App K, table 2 and 3.

Figure 5—Actual pumpage compared to projected pumpage for Waukesha using 1990 GPCD and actual population as basis for projection

Another example of the difficulty in making demand projections can be illustrated using the projections for 2010 in Appendix C, which was written in 2002. Appendix C projects a 2010 average day demand of 9.32 Mgd and a maximum day demand of 15.37 Mgd, using a ratio of 1.65. In contrast, the actual figures for 2010 were an average day demand of 6.68 and a maximum day demand of 8.65, with a ratio of 1.30. The overprediction for this 8-year period is 40 percent for the average day demand and 78 percent for maximum day demand.

Demand projection is a difficult field, because it must account for possible future changes that are unknown. It must be precautionary in the sense of projecting the greatest possible demand and make appropriate assumptions in doing so. It should, however, be consistent with historical data and planned implementation of CEMs. These might at least hold GPCD stable at the recent level of 86. More likely, these measures would continue the historical decreasing trend. Measures directed at outdoor watering might decrease the ratio of maximum day pumpage to average day pumpage. Maximum day pumpage from 1970 to 2008 is almost always during the summer (Appendix K, table 3), a period during which most outdoor watering occurs. If demand projections are to be inconsistent with historical trends and with planned conservation and efficiency measures, then a clear explanation should be given of why changes in GPCD trends and ratios of maximum day to average day pumpage are anticipated.

A future demand scenario for 2050 could be made assuming that all downward historical trends in GPDC cease as of 2010, that proposed CEMs are successful in conserving water, and that the ratio of maximum to average day demand remains the same as the recent average from 2006-2010. The 2010 GPDC was 86 (Final Conservation Plan, figure 4-6), unaccounted for water from 2007-2010 averaged about 6 percent (Final Conservation table 4.1), and 2050 estimated population is 97,400. The average day demand for this scenario is 8.9 Mgd. With additional conservation savings of 10 percent (Appendix D, exhibit 11), the average day demand decreases to 8.0 Mgd. The ratio of average maximum to average day pumpage from 2006-2010 is 1.38 (Final Conservation Plan, table 4.2). Using this recent ratio, maximum day demand is 11.1. Again, note that this estimate does not assume that the clear and decreasing trend in GPDC continues. Rather it assumes, conservatively, that GPDC remains constant from 2010 to 2050.

Sources of Water Supply

This section discusses potential sources of water supply to meet Waukesha's future needs. These are evaluated with respect to the hydrological feasibility and environmental impact of the withdrawal. Costs related to infrastructure, treatment, and greenhouse gas emissions, for instance, are not considered.

Several documents listed at the end of this paper explore alternative sources of water for Waukesha's future needs. In these documents, sources were evaluated by several criteria and compared to each other. Additionally, possible combinations were explored, though not all possibilities, since all possible combinations is a very large number. This paper does not describe the alternative sources in detail, because such detail is given in many of the documents listed at the end of this paper.

Currently, Waukesha has two sources of water supply: (1) The Cambrian-Ordovician Aquifer, which is a relatively deep and confined aquifer, referred to as "deep confined aquifer" in this paper; and (2) sand and gravel deposits of glacial and recent origin, some unconfined and others semiconfined, referred to as "shallow aquifer" in this report". Waukesha has 10 wells in the deep confined aquifer. Two wells (#1 and #4) are no longer used due to contamination from human sources (#1) or the potential for contamination from human sources and low yield (#4). Well #2 was recently taken out of service due to decreasing yield. The remaining 7 wells have a combined capacity of 14.35 Mgd. Waukesha has 3 wells in the shallow aquifer near the Fox River. These 3 wells have combined capacity of 2.38 Mgd.

Natural sources of radium in the deep confined aquifer, and the costs associated with treatment to meet radium standards at all points of entry into the water supply system, were major factors that motivated Waukesha to explore alternative sources of water supply. In Waukesha's Future Water Supply study (Appendix C), fourteen alternative sources are considered. Nine are not discussed in detail, being removed from consideration using the evaluation criteria. Five are

considered in more detail. The result of this analysis indicated that the best alternative source is a diversion from Lake Michigan (although Appendix C, written in 2002 before the Compact was completed, concluded this was only feasible if no return flow to Lake Michigan was required). The Application considers 6 alternative sources. Two are not discussed in detail, being removed from consideration using the evaluation criteria. Four are considered in more detail, and three of these are a combination of sources. The result of this analysis indicated that the best alternative source is a diversion from Lake Michigan. Additionally, WDNR requested that Waukesha reconsider the unconfined aquifer west of Waukesha (it was one of the two not considered in detail in the Application) and that they also consider a multiple source alternative. These latter two are reported in Response to Water Supply Questions WS7, WS7A, and WS10.

Evaluation Criteria and Issues

The Application used four main criteria for evaluating alternative sources and return flow: environmental impact, long-term sustainability, public health, and implementability. These criteria were chosen based on a Wisconsin Statute that defines a “reasonable water supply alternative” and which is applicable to a community in a straddling county in Wisconsin that wishes to apply for a diversion.

In the discussion of many of the alternative sources in the Application, five common concerns or issues are raised which this author views as problematic. These are discussed below.

The first is concern about contamination of source water supply. This results in lower ranking for sources in rivers or shallow aquifers, yet higher rankings for Lake Michigan. In fact, all sources are susceptible to contamination and need protection. Deep confined aquifers are typically viewed as those safest from contamination, yet 20 percent of Waukesha’s wells in the deep confined aquifer are not used due to contamination, or the potential for contamination, from human sources. Lake Michigan, viewed as “high quality and safe” in the Application, was the source of a major water-borne disease outbreak in Wisconsin in the 1990s. These two examples illustrate that all water sources, even those deemed safe, can be contaminated. Rivers and groundwater are used throughout the Upper Midwest as sources of safe, potable water. Therefore concern about contamination of source water supply is not part of the evaluation in this paper.

The second are issues related to the effect of groundwater withdrawals on Waters of the Great Lakes Basin. By Compact definition, none of the groundwater sources considered by the Application are Waters of the Great Lakes Basin. Stopping deep confined aquifer pumping in Waukesha will not improve the Waters of the Great Lakes Basin; continued pumping in Waukesha will not impair Waters of the Great Lakes Basin. Regionally in southeast Wisconsin pumpage from the deep confined aquifer does result in a small amount of inducement of flow from Lake Michigan (1.33 Mgd in the SEWRPC model for 2000) and a small amount of capture of water that would have flowed to Lake Michigan (2.67 Mgd) and an unknown amount of streamflow capture and inducement within the Great Lakes Basin (not reported separately by

watershed for SEWRPC model, though the total from inside and outside the Great Lakes Basin was 19.7 Mgd). Besides having small or unknown impacts on Waters of the Great Lakes Basin, there has been no study to indicate how changes in only Waukesha's pumping, using updated pumping in the area, will affect flow of groundwater to Lake Michigan or to streams tributary to Lake Michigan. Without knowing the impacts of continued or no pumpage from the deep confined aquifers, there is nothing to say about the environmental impacts on Waters of the Great Lakes Basin. Therefore the pros or cons of pumpage from the deep confined aquifer, with respect to impacts on Waters of the Great Lakes Basin, are not part of the evaluation in this paper.

The third issue is the Application's evaluation of how uses of various sources will or will not meet Compact requirements (Application exhibit 4-20). This exhibit treats the deep confined and shallow aquifer sources in Waukesha as Waters of the Basin, which they are not. The Compact sections referenced in the first column of exhibit 4-20 refer only to Source watershed and water sources that are parts of Waters of the Great Lakes Basin. They do not apply to other water sources in Wisconsin. Therefore the final two columns in exhibit 4-20 are not relevant to Compact requirements and should be filled in with "NA—not applicable". The Application's line of reasoning in this regard is illustrated by the following statement from Appendix D, p. 31 (and quoted in the Application):

One of the decision making standards of the Compact (4.11.1) states "All Water withdrawn shall be returned, either naturally or after use to the Source watershed less allowance for Consumptive Use." Since the deep aquifer and the waters of the Lake Michigan Basin are hydrologically connected, pumping the deep aquifer and discharging the water into the Fox River does not comply with this Compact decision-making standard.

In fact, the Compact states that groundwater outside of the watershed boundary of the Great Lakes is not in any of the Source Watersheds of the Great Lakes Basin. Thus the Compact Decision-Making Standard is not relevant to Waukesha's return of wastewater from groundwater sources to the Fox River. Therefore the evaluation in this paper separately treats Waters of Wisconsin outside the Great Lakes Basin and Waters of the Great Lakes Basin and does so in a manner consistent with Compact language.

The fourth issue is related to statements about continued decline of water levels in the deep confined aquifer, such as "drastically declining water levels". The regional groundwater modeling done for SEWRPC clearly showed the historical and significant declines of groundwater levels in the deep confined aquifer. However, pumping patterns and amounts have changed. In particular, pumping in many areas has decreased (Waukesha, for example, has had decreasing pumpage since the late 1980's, as shown in Figure 1). There are only two long-term monitoring wells in the deep confined aquifer in southeast Wisconsin, in Kenosha and Walworth counties. Both of these wells show stable or increasing trends in recent years (Figure 6), although they are certainly also affected by decreases in pumpage in the Chicago area. Claims in the Application regarding continued groundwater level declines are without substantiation. That is, no

observational data are presented that show continued groundwater level declines. A 2010 USGS report used regional pumpage around Lake Michigan through 2005 to evaluate changes in water levels, among other things. This model shows simulated heads in Waukesha increasing after 1986 (Figure 7).

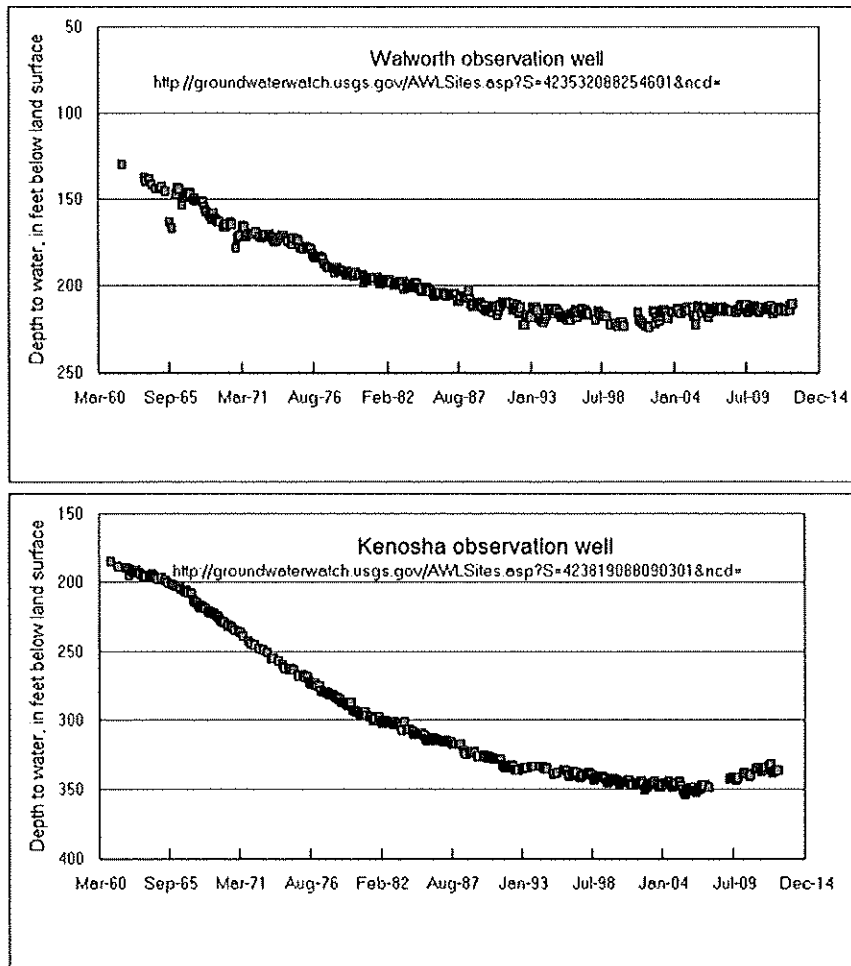


Figure 6—Historical groundwater levels for two observation wells in the deep confined aquifer in southeast Wisconsin.

Therefore, negative impacts linked to groundwater level declines in the Application may not occur. These include: increasing radium and TDS levels (with economic, public health, and environmental issues); decreasing well capacity (with economic and sustainability issues); and decreased flow to surface water (with environmental issues). Each of these potential impacts and issues are important, especially the issue of radium and TDS levels. Waukesha has several wells that would each have to be treated to comply with water quality standards. Future degradation in water quality or well capacity caused by future declining groundwater levels,

however, will only occur if levels decline. Therefore these factors, as they relate to declining groundwater levels in the deep confined aquifer, are not part of the evaluation in this paper.

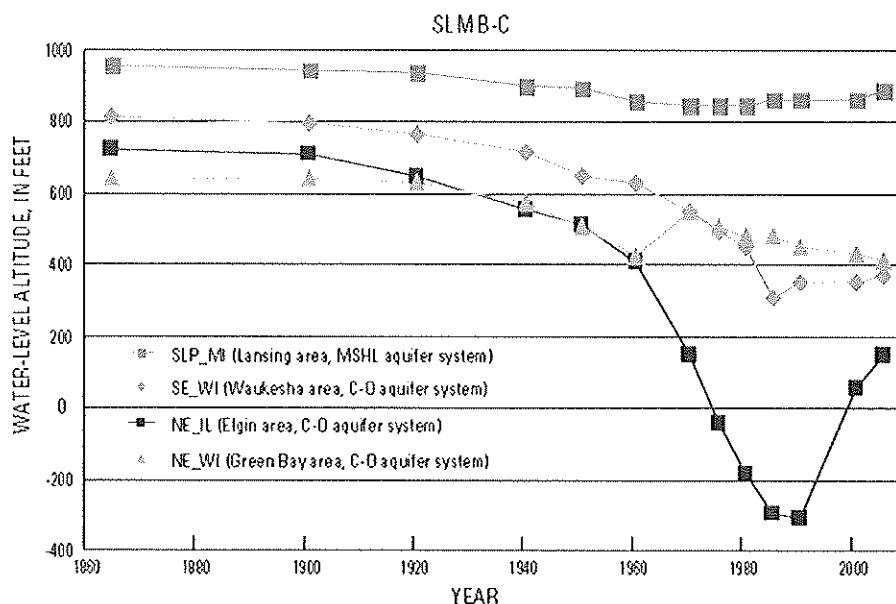


Figure 7—Simulated groundwater levels 1864 through 2005 in Lake Michigan area.

The fifth issue is related to treating water to meet drinking water standards and how this affects the merit of various sources. All of the types of water supply sources considered in the Application are used throughout the Upper Midwest. All are treated to meet drinking water regulatory standards or for aesthetics. The only real issue here is economic, that is, the costs of various treatments, which this paper does not consider. Therefore issues related to treating water to meet drinking water standards are not part of the evaluation in this paper.

Discussion of Alternative Sources

This section discusses the alternative sources considered in the Application and provides an evaluation of each. Combinations of sources are not evaluated. Evaluation includes the availability of information regarding capacity of the source, sustainability, and environmental impacts of the withdrawal. There is no evaluation of a return flow to Lake Michigan.

Artificial Recharge

Artificial recharge is not actually a source, but rather replenishes the shallow aquifer and mitigates some of the impacts of water withdrawals from that aquifer. Artificial recharge consists of inducing stormwater or treated wastewater to recharge aquifers. It is a common practice in some water-scarce areas of the U.S. A related concept is Aquifer Storage and Recovery, which is considered in some detail in Appendix C.

As noted in the Application, there are significant concerns related to using artificial recharge in shallow aquifers near Waukesha. These include access to substantial land areas for infiltration, potential contamination from stormwater, regulatory obstacles to using treated wastewater to recharge a potable drinking aquifer, the long-term viability of infiltration facilities (including those on land surface and in wells), and the potential to mobilize arsenic in the shallow aquifer using ASR. Furthermore, no estimates are available regarding how much capacity could be added to a shallow aquifer source near Waukesha using artificial recharge or how much artificial recharge would increase water levels in the shallow aquifer. Therefore, this potential supplement to water supply sources for Waukesha is not considered further in this paper.

Deep Unconfined Aquifer west of Waukesha

West of Waukesha, the Maquoketa Shale is absent, leaving the Cambrian-Ordovician Aquifer unconfined. Because it is unconfined, the deep aquifer west of Waukesha has much better hydraulic connection to the shallow aquifer than the confined portion, and is therefore more connected to surface water features, such as streams, lakes, and wetlands. This water supply source is dealt with briefly in the Application and more fully in *Response to Water Supply Questions, Attachment WS7 and WS7A*. Appendix C concluded this was a viable water supply source, except for legal considerations regarding access to land and potential negative impacts on surface water bodies. As noted in WS7, the aquifer produces water of good quality.

WS7 discussion of environmental impacts is based on findings from a groundwater flow model described in WS7A. These studies looked at the feasibility of meeting all of Waukesha's projected water needs in 2050 from the deep unconfined aquifer west of Waukesha, 10.9 Mgd average day demand and 18.5 Mgd maximum day demand, although those exact amounts of withdrawal were not simulated. WS7 states that at 15 Mgd the drawdown in the shallow aquifer would be less than 2 feet and that at 10 Mgd pumping would impact 480 acres of wetland and over 100 acres of surface waters within the 1-foot drawdown contour line in the shallow aquifer.

WS7 concludes that withdrawals from the unconfined deep aquifer would have a significant adverse environmental impact and a significant adverse impact on long-term sustainability, which this author assumes to mean these withdrawals are not sustainable. The arguments against sustainability, however, refer back mostly to those related to groundwater connection to Waters of the Great Lakes Basin and effect on groundwater levels in the deep confined system. These issues were discussed previously, and this paper concludes that no substantive issues regarding long-term sustainability are presented in WS7. The aquifer is largely protected from effects of drought, and the only issue of long-term sustainability would be increasing demand on the aquifer from new or increased withdrawals other than Waukesha's.

WS7A summarizes the use of the SEWRPC regional model to simulate pumping from the unconfined deep aquifer west of Waukesha. The modeling effort described in WS7A has

technical issues. First, the SEWRPC model is not appropriately discretized for evaluation of local groundwater-surface water relationships, as noted in SEWRPC Memorandum Report 188 (MR 188). The telescoping mesh refinement should have been used, as it was in MR 188. Second, all of the pumpage was simulated from two wells in the proposed well field due to a misunderstanding that wells could not be simulated in layers 11 through 16 if layer 1 was represented as a surface-water feature. Thus the entire pumping amount was split among 2 simulated wells, rather than the 13 proposed for the well field in WS7. Concentrating unrealistically high amounts of pumpage into a single model cell exacerbates the local effects of drawdown. They are unrealistically high. Third, the MODFLOW module used to represent streams is not specified. If it is STR, then that is appropriate boundary condition (STR limits the amount of water than can flow from a stream into an aquifer according to flow estimates for that stream). However, WS7A does not state how streamflow was estimated for cells, nor how stream losses were compiled along a stream to calculate baseflow reduction. If RIV was used as a boundary condition, then unrealistically large amounts of water could be produced from these cells (RIV does not limit the amount of water that can flow from a stream into an aquifer). The effect of this could be to overestimate the amount of water induced from streams, but it also could be to underestimate drawdown in the uppermost layer, since the water level in so many cells is fixed by a surface water feature.

Therefore this paper concludes that there is insufficient information to determine if the unconfined deep aquifer west of Waukesha can provide for all or a significant part of Waukesha's future water supply needs without causing significant adverse environmental impacts to streams, lakes, and wetlands.

Silurian Dolomite Aquifer

The Silurian Dolomite aquifer, where not eroded through in bedrock valleys, directly underlies the glacial deposits in the Waukesha area. This aquifer can be very productive throughout eastern Wisconsin, and in fact, throughout much of the Great Lakes region. The aquifer is heterogeneous with respect to hydraulic conductivity, however, because it depends on subvertical fractures and subhorizontal bedding plane openings to transmit water. Therefore, productivity can vary greatly from place to place. The Silurian Dolomite aquifer provides water for municipal supplies in and near Waukesha, about 30 wells in eastern Waukesha County. Water from this aquifer can have objectionable levels of manganese and iron, which typically require treatment. Similar to the unconfined deep aquifer west of Waukesha, the Silurian Dolomite aquifer has good hydraulic connection to the overlying shallow aquifer, which means it has better connection to surface water features than does a confined aquifer. Where glacial deposits are thin, the Silurian Dolomite aquifer may be susceptible to drought; where glacial deposits are thick, they dampen the effect of drought on the Silurian Dolomite aquifer.

Attachment WS8 of the Response to Water Supply Questions evaluates The Silurian Dolomite aquifer as a potential water-supply source. WS8 notes that casing requirements of at least 60 feet and Silurian dolomite thickness requirements of at least 100 feet limit the geographic areas

that could produce significant quantities of water. Well yields in the area are variable, but an average of 450 gpm from 3 to 5 possible wells may be realistic in the opinion of the WS8 author (the WS8 author is very experienced with developing municipal water supplies from the Silurian Dolomite Aquifer in this part of Wisconsin). If 3 to 5 wells were developed and produced 450 gpm each, then the well field would yield 1350 to 2250 gpm.

The Silurian Dolomite aquifer cannot meet all of Waukesha's projected 2050 water needs. However, this aquifer could provide 1.9 to 3.2 Mgd with 3 to 5 wells pumping 450 gpm each. Municipal wells in the Silurian Dolomite aquifer must have at least 60 feet of glacial deposits, which protects the aquifer in these areas from major withdrawal issues related to drought.

The Silurian Dolomite aquifer is not presented in the Application as an alternative source. It is presented as one of the 14 alternative sources in Appendix C, but is one of the 9 that are not considered in detail. It is eliminated because it cannot meet all of Waukesha's projected 2050 water needs. No discussion of any environmental impacts resulting from withdrawals from the Silurian Dolomite aquifer is presented in Appendix C or WS8. This author assumes there could be some local effect on surface water features because of the hydraulic connection to the overlying glacial deposits. However low porosity and highly transmissive solutional features tend to spread out effects of pumping and also make them unpredictable locally.

Deep Confined Aquifer

Using the deep confined aquifer as a source of water is described in detail in many of the documents listed at the end of this paper. Currently, this is the major source of water for Waukesha. The reasons to seek other sources have already been noted above.

The capacity of Waukesha's 7 remaining wells in the deep confined aquifer is 14.35 Mgd. The Application states these wells will be used at a rate of 7.6 Mgd, with treatment of 3 of the wells for TDS and radium. In the Application, use of the deep confined aquifer is only evaluated as an alternative in combination with use of the shallow aquifer. It is not evaluated as the sole source.

The issue of the long-term sustainability of this aquifer at historical regional rates is a regional concern. These concerns launched many regional and local studies related to future water use and supply. Results from the SEWRPC model led to the conclusion that ongoing regional increases in withdrawals from the deep confined aquifer do not appear to be sustainable.

There are ongoing changes in the region, however, that suggest that demand on this aquifer may not increase at rates similar to historical ones of the 20th century. Demand increase is slowing in some areas and declining in some areas. Some communities that historically relied on the deep confined aquifer have switched to shallow aquifers and to Lake Michigan. Groundwater levels may be stabilizing or increasing regionally (see figures 6 and 7). According to SEWRPC, groundwater pumpage in the 7-county SEWRPC region and in Waukesha County

decreased from 2000 to 2005 (this includes all sources of groundwater). In the City of Waukesha, total pumpage has been decreasing since the late 1980's.

Locally, Waukesha's use of the deep confined aquifer may be sustainable in the long-term. Waukesha's total water use has declined from about 9 Mgd in the mid-80's to about 7 Mgd in recent years, a reduction of 20 percent. Use from the deep confined aquifer has declined a greater percentage, since the 3 wells in the shallow aquifer are relatively new (#11 and #12 began operation in 2006; #13 in 2009) and make up a part of the recent use of about 7 Mgd. As noted previously, there are no observational or model data presented to show that water levels in the deep confined aquifer are continuing to decline.

The Application presents only two types of negative environmental impacts from using the deep confined aquifer: (1) the effect of regional withdrawals from this aquifer on regional surface water supplies and (2) increasing chloride loading to streams from use of home water softeners. (Note, the Application presentation of other environmental impacts is discussed under *Evaluation Criteria and Issues* previously in this paper). Any waste stream discharged to the Fox River would have a permit requiring it meet water quality standards of Wisconsin, which are developed to protect against negative environmental impacts.

The SEWRPC regional groundwater flow model has not been used to specify only the impact of Waukesha's use of the deep confined aquifer on streams. It is not possible with a regional groundwater flow model to determine the local impact of Waukesha's use of the deep confined aquifer on specific small streams, such as Pebble Brook or Mill Brook. The amount and location(s) of impacts on streams remain unknown until appropriate local modeling is done. Similarly, the amount and location of any positive impact to streams from Waukesha stopping pumpage from this aquifer is unknown. If part of the effect is a flow reduction in the upper Fox River, then this reduction is mitigated by wastewater return. We do know how much of the source of water to Waukesha's deep confined aquifer wells is ultimately either release from storage (lower water levels) or from surface water (by inducement or capture). Though there is some negative impact on one or both, but less than there was in the 1980s. Thus it is not possible with information presented in various reports to quantify environmental impacts of Waukesha's use or nonuse of the deep confined aquifer.

Shallow Aquifer

The shallow aquifer consists of coarse unconsolidated sand and gravel of glacial or recent origin. Within the aquifer are deposits of fine material of the same origin, which act as confining units. As noted in many of the documents listed at the end of this paper, the distribution of coarse and fine material is very complex, difficult to map, and difficult to simplify for groundwater flow modeling.

The major negative environmental impact of withdrawals from the shallow aquifer is the reduction of groundwater flow to surface water bodies and the resulting ecological impacts.

Thus this analysis focuses on the effect of groundwater withdrawals on surface water. The shallow aquifer is directly connected to surface water bodies, such as the Fox River, Pebble Brook, and Vernon Marsh. All groundwater modeling studies that include the shallow aquifer recognize the complexity of understanding the local relationship between groundwater withdrawals from the shallow aquifer and effects on surface water bodies. Correct understanding of this relationship requires significant hydrogeological and monitoring data along with properly constructed groundwater flow models, with careful attention to the boundary conditions that represent the surface water bodies. A particular challenge is knowing the resistance to flow in the shallow materials that make up the surface of streambeds and wetlands. Even when known, it is difficult to represent that resistance appropriately in model cells that represent surface water features. Where transient data are available, a model can be calibrated to approximate this resistance appropriately. For some important surface water bodies, such as Vernon Marsh, no data are available to calibrate a groundwater flow model to a known system response of the marsh to a known system stress, such as a well.

The various local and subregional studies of groundwater withdrawal from the shallow aquifer describe or differentiate among three sources within the shallow aquifer. One is the Troy Bedrock Valley, another is the Fox River Alluvium, and the third is aquifer material not associated with the former two. The differentiation among these aquifers is, however, not clear in some of the reports. The alluvium in the Fox River Valley is fairly thin and discontinuous and no actual or simulated wells derive all of their water from these deposits. So, in this paper, wells in the Fox River Alluvium refer to wells that are in close proximity to the Fox River, are screened in glacial materials, and induce or capture a significant portion of their water from the Fox River. According to MR-188, Waukesha currently has no wells in the Troy Bedrock Valley. Waukesha wells #11 and #12 are in the Fox River Alluvium. Waukesha well #13 is in aquifer material other than the Troy Bedrock Valley or Fox River Alluvium.

Application Alternative 1 (deep and shallow aquifer) uses current shallow aquifer wells #11, #12, and #13 with a capacity of 2.38 Mgd (firm capacity of 1.2 Mgd), plus 14 new wells south of Waukesha near Vernon Marsh in the Troy Bedrock Valley with a firm capacity of 9.7 Mgd.

Application Alternative 2 (shallow aquifer and Fox River alluvium) uses current shallow aquifer wells #11, #12, and #13 with a capacity of 2.38 Mgd (firm capacity of 1.2 Mgd), 4 new Fox River Alluvium wells with a firm capacity of 4.5 Mgd, plus 14 new wells south of Waukesha near Vernon Marsh in the Troy Bedrock Valley with a firm capacity of 12.8 Mgd.

Troy Bedrock Valley

According to MR 188 (Troy Bedrock Aquifer model Waukesha and Walworth Counties), the Troy Bedrock Valley trends through three Wisconsin counties, including southern Waukesha County and includes tributary valleys that are not all fully mapped. The valley is filled with glacial deposits that range from fine confining material to coarse aquifer material. Several

municipalities in southeast Wisconsin supply drinking water from the Troy Bedrock Valley aquifer.

MR 188 describes a groundwater flow model developed to assist in understanding groundwater flow in the Troy Bedrock Valley aquifer. The authors used existing data from wells, borings, geophysical surveys, aquifer tests, and water level measurements to develop a hydrogeological understanding of the valley for designing the groundwater flow model. The model was extracted from the SEWRPC model. Telescoping mesh refinement was used because the SEWRPC model horizontal discretization is too coarse to simulate the effects of groundwater withdrawals on surface water at a local scale.

Deeper aquifer materials in the Troy Bedrock Valley are typically confined by 200 feet or more of fine material. However, MR 188 points out that there are local gaps ("windows") in the confining material which allow better hydraulic connection between deeper aquifer material and shallow material. The location of these windows is known only where drilling or boring data have found them. There are certainly other windows than the known ones. Locally, the location of windows would be critical for understanding if a new well might impact a nearby surface water body. Additionally, if windows were in the area of a simulated well field, then any groundwater flow model would have to account for this by treating the lower sand unit as unconfined, rather than confined.

Appendix O describes the application of the model developed in MR 188 to four development scenarios. Scenario 1-1 simulates pumpage of 6.4 Mgd from 8 wells: existing wells #11, #12, and #13; and 5 wells in the area referred to as the Lathers property. Scenario 1-2 simulates pumpage of 6.4 Mgd from 17 wells: existing wells #11, #12, and #13; 5 wells in the area referred to as the Lathers property; and 9 wells in the Troy Bedrock Aquifer. Scenario 2-1 simulates pumpage of 10.9 Mgd from 12 wells: existing wells #11 and #13; 3 wells in the area referred to as the Lathers property; 4 wells in the Troy Bedrock Aquifer; and 3 wells near the Fox River. Scenario 2-2 simulates pumpage of 10.9 Mgd from 28 wells: existing wells #11, #12, and #13; 5 wells in the area referred to as the Lathers property; and 20 wells in the Troy Bedrock Aquifer. Appendix O describes the impact of these withdrawals on various nearby surface water bodies and on domestic wells in the area.

The text for Appendix O is brief; less than 3 pages. Therefore reviewing this modeling effort is difficult. However, several observations are possible. First, there is nothing said about impacts on domestic wells. The number in each section is plotted on maps of drawdown, but their location and screen depths are not given. So no conclusions can be drawn regarding impact on domestic wells. Second, the location of the simulated wells relative to the map of the Troy Bedrock Valley presented in MR 188 is not shown. Are they actually in the valley? Comparison of figure 1 in MR 188 to the maps in Appendix O suggests the simulated wells are outside or at the edge of the Troy Bedrock Valley. It is difficult to determine. Could wells be simulated further south, away from Pebble Brook and Mill Creek and closer to the center of the Troy Bedrock

Valley? Third, no information is given on the depth or layer of the Lather property or Fox River wells.

Fourth and most importantly, the concluding paragraph of MR 188 provides advice that is vital to doing model simulations such as those in Appendix O, but which appears to have been not been followed. That paragraph states:

It must be kept in mind that the geologic conditions in the Troy Bedrock Valley are only known in general terms. While the regional flow system is well described, the bedrock valley aquifer system is more complex than currently known. The model cannot, and does not, account for these unknown complexities, nor does it fully incorporate all of the geologic data available which can vary on scales smaller than the cell size of the model. Some of these variations between the model and the natural system may be significant, particularly on a local scale. In applying the model to estimate the local impacts to a particular water body or specific area it will be essential to consider the degree of geologic complexity necessary to produce a simulation to the degree of desired detail. It may be necessary to revise portions of the model or construct inset models within the larger model to obtain the degree of detail required for specific applications. In many cases it may be necessary to conduct additional testing to obtain the data needed and the degree of local detail desired.

Furthermore, D.S. Cherkauer's 2007 report to the Board of the Town of Waukesha regarding groundwater at the Lather's property presents a comprehensive set of questions that need to be answered to understand the impacts of withdrawals on domestic wells and surface water resources. The report also presents the information needed to answer these questions and whether or not that information is available. While many of these issues are addressed at a multi-county scale in MR 188, they are not addressed locally in Appendix O.

Fox River Alluvium

Municipal wells in the shallow aquifer in close proximity to the Fox River can derive a substantial amount of their water from induced flow from the river and captured groundwater that would otherwise flow to the river. This process is known as riverbank inducement (RBI). There are two principal effects from using RBI. First, there will be a significant reduction in Fox River baseflow. Second, there will be less drawdown, thus less impact on domestic wells and nearby surface water features, because release of water from storage becomes a smaller source of water to the municipal wells. The first effect can be mostly mitigated if wastewater return is upstream of a well field, since all of the water, less consumptive losses, would be returned to the portion of the Fox River affected by pumping. A probable consequence of having wastewater return upstream of a well field is an increasing concentration of chloride, and other constituents common to treated wastewater, in the well field water. Current wells #11 and #12 are RBI wells, whereas #13 is not. #13 derives its water from west of the well, not from the Fox River.

A recent USGS report (SIR 2012-5108) describes development and application of a groundwater flow model to hypothetical wells pumping from the Fox River Alluvium. The model is finely discretized horizontally and vertically. It uses a statistical approach to develop the hydrogeologic framework, resulting in two models (fine-favored and coarse-favored) that potentially bracket the system response to pumpage. The model uses boundary conditions that account for the amount of water in the Fox River. Flows in or out of the bottom of the model are set based on the SEWRPC model.

The model described in SIR 2012-5108 has 2 sets of wells: 12 wells downstream of the Waukesha WWTP and 15 wells upstream. Pumpage from each well is constrained to a maximum of 0.667 Mgd. For the simulation, the two sets of wells produce a little over 9 Mgd, about 3 Mgd from the upstream wells and about 6 Mgd from the downstream wells. Some downstream wells likely could have produced more than 0.667 Mgd had they not been constrained to that amount.

Two types of impacts of the hypothetical modeling are described. The fine-favored model derived about 65 percent of its water either by inducing flow from the Fox River or capturing water that would have flowed to the river; for the coarse favored model, the number is about 73 percent. For both models, maximum drawdown in the uppermost layer is 20 feet. Maximum drawdown in layer 3 is 30 feet (most wells pump from layers 3 and 4). Sensitivity analysis showed that without RBI drawdown in layer 1 drawdown would be as much as 90 feet, demonstrating the positive effect of RBI on issues related to drawdown.

The model described in SIR 2012-5108 is not a planning tool for a municipal well field. It does, however, suggest that a substantial part of Waukesha's water supply could come from a similar well field that uses RBI to reduce drawdown impacts and uses treated wastewater return flow to mitigate most of the effects of RBI on baseflow in the Fox River. A site-specific study for a well field similar to the one represented by the 12 downstream wells could also incorporate aquifer management modeling. Aquifer management models can maximize pumpage from each well, while using constraints to minimize impacts on drawdown and surface water bodies other than the Fox River.

Lake Michigan

Lake Michigan can provide sufficient water to meet all of Waukesha's future needs. Any impact of a withdrawal on Lake Michigan would be negligible. The loss of the current wastewater return to the Fox River would result in smaller baseflow in the river downstream from the current WWTP. Appendix N states that there would be a 25 percent reduction in the upper Fox River near Waukesha, assuming an average annual WWTP discharge of 10 Mgd. Appendix N concludes that the likely effect of this flow reduction would be a small adverse environmental impact on aquatic habitat. Effects on the Fox River may be mitigated to some degree by local increases in groundwater flow to surface water if Waukesha stops using groundwater.

Evaluation of Alternative Sources

This paper does not use the evaluative criteria from the Application for reasons stated previously. Alternative sources are evaluated by: (1) hydrological feasibility of the withdrawal; (2) the environmental impacts of the withdrawal on Waters of Wisconsin outside the Great Lakes Basin (that is, waters that are not defined as *Waters of the Basin* in the Compact); and (3) environmental impacts of the withdrawal on Waters of the Great Lakes Basin, defined as *Waters of the Basin* in the Compact. Hydrological feasibility includes capacity of the source, sustainability, and other issues; it is merely a summary of conclusions reached in the previous section. There is no evaluation of a return flow to Lake Michigan.

Deep Unconfined Aquifer west of Waukesha—This is a viable source of water supply with good water quality. The aquifer is largely protected from the effects of drought, and there are no substantive issues of long-term sustainability. The amount of water that can be pumped from this aquifer without causing significant adverse impacts to surface water bodies has not been determined. There would likely be adverse impacts on shallow domestic wells and surface water features, but the amount of impact is not known. The groundwater flow model used could not appropriately address these issues. Therefore the environmental impacts of withdrawals on Waters of Wisconsin are unknown. There are no environmental impacts of withdrawals on Waters of the Great Lakes Basin.

Silurian Dolomite Aquifer—This aquifer could provide a sustainable supply of 2 to 3 Mgd. The potential environmental impacts of withdrawals are not presented. Therefore the environmental impacts of withdrawals on Waters of Wisconsin are unknown. There are no environmental impacts of withdrawals on Waters of the Great Lakes Basin.

Deep Confined Aquifer—This aquifer could supply up to 14 Mgd from existing operational wells, although the Application only considers smaller withdrawals (7.6 Mgd) from this aquifer in combination with other sources. Withdrawals from this aquifer may be sustainable, however specific modeling to consider sustainability was not done. That is, no modeling scenario was run using updated regional pumping and ongoing pumpage of 7.6 Mgd from Waukesha. Specific impacts of Waukesha's pumpage on surface water are not known, because modeling done to consider this was done using a regional model, rather than a local model. Therefore the environmental impacts of withdrawals on Waters of Wisconsin are unknown. There are no environmental impacts of withdrawals on Waters of the Great Lakes Basin.

Shallow Aquifer (Troy Bedrock Valley Aquifer)—The amount of water that could be withdrawn from this aquifer without having significant adverse impacts on surface water or domestic wells has not been determined. There would likely be adverse impacts on shallow domestic wells and surface water features, but the amount of impact is not known. The groundwater flow model used could not appropriately address these issues. Therefore the environmental impacts of withdrawals on Waters of Wisconsin are unknown. There are no environmental impacts of withdrawals on Waters of the Great Lakes Basin.

Shallow Aquifer (Fox River Alluvium)—This aquifer may be able to provide a sustainable supply of 6 Mgd or more, provided there is wastewater return upstream to mitigate effects of reduced flow in the Fox River. The model of a hypothetical well field did not address any impacts on specific domestic wells. The Vernon Marsh was outside the local modeling area. There would likely be adverse impacts on shallow domestic wells and surface water features, other than the Fox River. Site-specific modeling of a planned well field would be needed to determine local effects on domestic wells and surface water. Therefore the environmental impacts of withdrawals on Waters of Wisconsin are unknown. There are no environmental impacts of withdrawals on Waters of the Great Lakes Basin.

Lake Michigan—This source can meet Waukesha's future needs. There would be some negative environmental impact on the Fox River due to smaller WWTP discharges. Therefore the environmental impacts of withdrawals on Waters of Wisconsin are small. There are no environmental impacts of withdrawals on Waters of the Great Lakes Basin.

Source	Hydrologic Feasibility and Issues	Environmental Impacts of Withdrawal on Waters of Wisconsin outside Great Lakes Basin	Environmental Impacts of Withdrawal on Waters of the Great Lakes Basin
Deep Unconfined Aquifer west of Waukesha	Sustainability and capacity to meet some or all of Waukesha's future demand cannot be determined from available studies.	Degree of impact of withdrawals on nearby surface water or domestic wells cannot be determined from available studies.	None
Silurian Dolomite Aquifer	Can provide a sustainable supply of 2-3 Mgd.	Not evaluated in available studies.	None
Deep Confined Aquifer	Available wells have a capacity of 14 Mgd. Sustainability of withdrawals to meet some or all of Waukesha's future demand cannot be determined from available studies.	Degree of impact of withdrawals on surface water cannot be determined from available studies.	None
Shallow Aquifer (Troy Bedrock Valley)	Sustainability and capacity to meet some or all of Waukesha's future demand cannot be determined from available studies.	Degree of impact of withdrawals on nearby surface water or domestic wells cannot be determined from available studies.	None
Shallow Aquifer (Fox River Alluvium)	Can provide a sustainable supply of at least 6 Mgd, provided wastewater return occurs upstream of well field.	Impacts on Fox River mitigated by wastewater return. Some negative impact on nearby surface water. Impact on domestic wells not studied.	None
Lake Michigan	Can meet all of Waukesha's future demand.	Baseflow reduction of about 25 percent downstream of current WWTP.	None

Table 5. Summary evaluation of Waukesha's alternative sources.

Summary and Conclusions

The goal of this paper is to provide an objective scientific analysis of particular aspects of the Application of the City of Waukesha's Water Diversion Application submitted to Wisconsin DNR (WDNR) in May 2010. Numerous other associated documents were also reviewed. The scope of this paper is limited to three aspects of the Application: conservation and efficiency measures, demand forecast, and sources of water supply. For sources the focus is on hydrologic and environmental aspects of withdrawals in the Application. Issues related to economic factors and return flow to Lake Michigan, for instance, are not addressed.

Conservation and Efficiency Measures

Waukesha developed a plan for water conservation in 2006 and updated it in 2012. The plan outlines Conservation and Efficiency Measures (CEMs) to meet a goal of 10 percent water savings by 2050 or 1.0 Mgd. The major CEMs are monitoring unaccounted for water, public education, replacing inefficient water fixtures, reducing outdoor watering, and pricing incentives. Specific water savings goals for each CEM are not given, other than for savings related to water fixtures.

Waukesha has relatively low unaccounted for water (about 6 percent) and plans to keep it low with ongoing response to issues shown from system audits. Public education is being carried out through various media and venues to ensure people are aware of the other CEMs. In the first three years of the fixture replacement program, only 88 toilets were replaced. Waukesha plans to increase the toilet rebate from \$25 to \$100, expand the types of inefficient fixtures in the rebate program, and expand the program to other use sectors other than just residential. Waukesha implemented outdoor watering restrictions in 2006, and these are part of the reason overall demand and maximum day demand have decreased since 2006. The pricing incentive is an inclining water rate block structure that was adopted by Waukesha in 2007 and is the first in Wisconsin. The structure has three rate blocks with a different cost of water in each. For instance, if a residential customer begins using more than 30,000 gallons in one quarter, then their cost of water is about 40 percent higher than when they were using 10,000 gallons or less. Waukesha is considering monthly, rather than quarterly, billing to provide better feedback to customers regarding their water use in each rate block, thus making the pricing incentive stronger.

Waukesha has set a specific conservation goal of 1.0 Mgd by 2050. It will be difficult to track progress toward meeting that goal for most of the CEMs, since there are many confounding factors that affect water use. However Waukesha's CEMs have been successful in conserving similar amounts of water at other municipal utilities in the U.S. If Waukesha's plan is fully implemented and successful, then the amount of water used per person each day (GPCD) should decrease.

Demand Forecast

Waukesha's demand for water has been decreasing since the late 1980's, although population has increased during that time. Thus, GPCD also has decreased since the late 1980s.

Waukesha's most recent demand forecasts for 2050 are an average day demand of 10.9 million gallons per day (Mgd) and a maximum day demand of 18.5 Mgd. Future average day demand is forecast by using a static GPCD of 112, future population estimates, assumptions on unaccounted for water, and a 10 percent reduction in demand from implementing CEMs. Future maximum day demand is based on a ratio of maximum day demand to average day demand of 1.68.

In contrast, Waukesha's 2010 GPCD was 86 and the ratio of maximum day demand to average day demand was 1.30. Only one year since 1970 had a ratio greater than 1.68; the average since 1970 is 1.46.

The demand forecast for 2050 does not account for historical trends in declining GPCD. There is no reason not to expect this decline to continue for some time. A conservative demand forecast could assume decreasing trends in GPCD cease at 86 and that CEMs will not decrease the ratio of maximum day to average day demand beyond the average from 2006-2010, which is 1.45. These assumptions would result in a demand forecast of an average day demand of 8.0 Mgd and a maximum day demand of 11.1 Mgd. To use these assumptions, however, one would have to provide convincing argument that declining trends in GPCD will cease and that CEMs will not further lower maximum day demand.

Alternative Sources

This paper evaluated six alternative sources of water supply: deep unconfined aquifer west of Waukesha, Silurian Dolomite aquifer, deep confined aquifer, shallow aquifer (Troy Bedrock Valley), shallow aquifer (Fox River Alluvium), and Lake Michigan. No combinations of sources were evaluated. These sources were evaluated according to (1) hydrological feasibility of the withdrawal; (2) the environmental impacts of the withdrawal on Waters of Wisconsin outside the Great Lakes Basin (that is, waters that are not defined as *Waters of the Basin* in the Compact); and (3) environmental impacts of the withdrawal on Waters of the Great Lakes Basin, defined as *Waters of the Basin* in the Compact. There is no evaluation of a return flow to Lake Michigan.

The Application raises some issues in evaluating the merits of alternative sources which this paper concludes are either a not an issue or not proven to be an issue. The first is concern about contamination of source waters. This paper points out that all sources can be contaminated, need to be protected, and that rankings related to this issue are not part of this paper's evaluation. The second are issues related to the effect of groundwater withdrawals on Waters of the Great Lakes Basin. This paper shows that none of the groundwater sources are Waters of the Great Lakes Basin and that no studies have been done to show how any changes in only

Waukesha's pumping would affect flow of groundwater to streams tributary to Lake Michigan. The third is the Application's evaluation of how uses of various sources will or will not meet Compact requirements. The Application treats the shallow and deep aquifers as Waters of the Great Lake Basin, which, by Compact definition, they are not. The fourth is related to statements of continuing decline of water levels in the deep confined aquifer. Available data and modeling show that water levels are stabilizing or rising due to recent regional changes, and there are no data presented in the Application to support the argument that significant declines are occurring nor modeling to show that they will occur. The fifth is related to treating source water to meet drinking water standards and how this affects the merit of different sources. All sources need to be treated, and since the issue is cost, it is not part of the scope of this paper.

Each of the alternative sources could provide some of Waukesha's future water needs. Some could meet all. There would be no adverse environmental impact from withdrawals on Waters of the Great Lakes Basin from any of the sources. For none of the groundwater sources, however, is there adequate information to determine the environmental impacts of withdrawals on the Waters of Wisconsin. For some sources, the information is inadequate because the groundwater model, as constructed, could not appropriately address the effect of groundwater withdrawals on surface water (unconfined aquifer west of Waukesha, deep confined aquifer and Troy Bedrock Valley). For others, the model or analysis were appropriately done, but effects of withdrawals on surface water features and domestic wells were not considered or within the scope of the modeling effort (Silurian Dolomite aquifer and Fox River Alluvium).

In conclusion, the Application's demand forecast and evaluation of alternative sources are problematic. The demand forecast does not provide justification for (1) using a GPCD that is higher than any of the last ten years; (2) assuming that the historical downward trends in demand will stop; and (3) why CEMs will not lower GPCD further and decrease the maximum day demand. The evaluation of alternative sources uses results of groundwater flow models that either (1) were inappropriately constructed to evaluate the effects of withdrawals on surface water and domestic wells or (2) did not specifically consider the effects of withdrawals on surface water and domestic wells.

Publications and Documents Reviewed

- 1998, March, 1997 Annual report of the Waukesha Water Utility to the Public Service Commission of Wisconsin, 71 p.
- 1999, P.W. Mayer and others, Residential End Uses of Water, 310 p.
- 2002, March, CH2MHILL, Appendix C, Waukesha Water Utility future water supply study, 135 p.
- 2002, July, United States Environmental Protection Agency, Cases in Water Conservation: How Efficiency Programs Help Water Utilities Save Water and Avoid Costs.
- 2004, April, 2003 Annual report of the Waukesha Water Utility to the Public Service Commission of Wisconsin, 80 p.
- 2005, June, D.T. Feinstein and others, A regional aquifer simulation model for southeastern Wisconsin, SEWRPC Technical Report 41, 63 p.
- 2005, December, Great Lakes – St Lawrence River Basin water resources compact, 27 p.
- 2006, March, Geosyntec Consultants, Appendix A, Waukesha Water Utility Water conservation and protection plan, 28 p. plus addendums and appendices, 176 p.
- 2007, September, D.S. Cherkauer, Ground water conditions around the Lather property, report to the Board of the Town of Waukesha, 24 p.
- 2009, March, 2008 Annual report of the Waukesha Water Utility to the Public Service Commission of Wisconsin, 91 p.
- 2009, May, AECOM, Appendix K, Final draft technical memorandum: summary of water requirements, 16 p.
- 2009, November, K.R. Bradbury and T.W. Rayne, Shallow groundwater quantity sustainability analysis demonstration for the southeastern Wisconsin region, SEWRPC Technical Report 48, 38 p.
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- 2010, February, D.S. Cherkauer, Groundwater budget indices and their use in assessing water supply plans for southeastern Wisconsin, SEWRPC Technical Report 46, 60 p.
- 2010, April, Appendix O, Results of groundwater modeling study: Shallow groundwater source Fox River & Vernon Marsh area Waukesha Water Utility, 13 p.
- 2010, April, CH2MHILL, Appendix D, Water supply service area plan for city of Waukesha, 53 p.
- 2010, May, Application for Lake Michigan water supply, 120 p.
- 2010, May, CH2MHILL, Environmental Impact Report City of Waukesha Water Supply, 326 p.
- 2010, December, SEWRPC, Regional water supply plan for southeastern Wisconsin, volume 1, PR-052, 831 p.
- 2010, December, SEWRPC, Regional water supply plan for southeastern Wisconsin, volume 2, PR-052, 329 p.
- 2010, D.T. Feinstein and others, Regional groundwater-flow model of the Lake Michigan Basin, USGS Scientific Investigations Report 2010-5109, 379 p.
- 2011, March, N. Quirk, Report on Water Conservation Programs to Public Service Commission of Wisconsin, 29 p.

2011, April, various authors, Responses regarding water supply, WS7, WS7A, WS9, WS10, WS11, 324 p.

2011, April, various authors, Responses regarding water conservation and water use efficiency, 367 p.

2011, September, A. Klusmeier and others, Summary of 2010 Utility Water Conservation Reports, Public Service Commission of Wisconsin, 16 p.

2011, November, C.A. Buchwald, Water use in Wisconsin, 2005, 74 p.

2011, December, CDM, Water Efficiency Potential Study for Wisconsin, 95 p.

2012, February, CH2MHILL, Environmental Report City of Waukesha Water Supply, 670 p.

2012, March, 2011 Annual report of the Waukesha Water Utility to the Public Service Commission of Wisconsin, 97 p.

2012, May, CH2MHILL, Final Water Conservation Plan, 168 p.

2012, D.T. Feinstein and others, Development and application of a groundwater/surface-water flow model using MODFLOW-NWT for the upper Fox River basin, southeastern Wisconsin, USGS Scientific Investigations Report 2012-5108, 124 p.

Commentary to UWM presentation to DNR on riverbank inducement, dated April 1, 2011.

Letter to Eric Ebersberger and others of the DNR from D.S. Cherkauer, dated June 17, 2011.

Letter to Eric Ebersberger of the DNR from Waukesha Utility Manager Dan Duchniak, dated July 29, 2011

Letter to Waukesha Utility Manager Dan Duchniak from Administrator Johnson, dated July 18, 2012

Letter to Secretary Cathy Stepp from Mayor Barrett and Alderman Hines dated July 18, 2012

Letter to Mayor Barrett and Alderman Hines from Secretary Cathy Stepp dated August 2, 2012

Web Site, USGS, Ground water in the and Great lakes: the case of southeast Wisconsin, <http://wi.water.usgs.gov/glpf/>

Acknowledgments—This analysis was funded by the National Wildlife Federation (NWF). Any opinions expressed are from the author and not from NWF. The author acknowledges the able assistance of Emily Posthumus in researching CEMs and providing draft materials for that section of the paper. Review of parts of the paper by several anonymous individuals was very helpful. Additionally, a team of Marc Smith (NWF), Peter McAvoy (UW Milwaukee), Karen Hobbs (Natural Resources Defense Council), and Jared Teutsch (Alliance for the Great Lakes) provided scoping advice during the analysis and reviews of the entire paper.

About the author—Jim Nicholas is owner of nicholas-h2o, working at the water science and decision-making nexus and providing assistance to organizations in the Great Lakes region. Previously, as Director of the USGS Michigan Water Science Center he helped lead statewide and bi-national research efforts to better understand the relationship of groundwater and surface water in support of the Great Lakes-St Lawrence River Basin Compact and related Michigan legislation. During his 33-year career at USGS, he helped conduct, plan, or review scores of groundwater projects, including ones that examined flow in glacial deposits, Cambrian-Ordovician aquifer, and Silurian Dolomite aquifer. Jim has been a technical advisor to several state and regional groups that deal with the application of hydrology to policy, regulatory, and resource management issues. He holds a B.S. in Geology from Wheaton College, an M.S. in Geology from Northern Illinois University and an M.S. in Civil Engineering—Water Resources from Stanford University.

WAUKESHA WATER UTILITY
CITY OF WAUKESHA, WISCONSIN
Public Briefing on Great Lakes Water Application

PUBLIC COMMENT FOR DEPT. OF NATURAL RESOURCES

November 14, 2013

Waukesha's application is currently being reviewed by the Wisconsin Department of Natural Resources. If you want to provide comments to the DNR, you may drop this completed form in the **COMMENT BOX** or you may mail it to the DNR at Wisconsin DNR, DG/5, PO Box 7921, Madison, WI 53707-7921, Attention: Kassie Lang, no later than December 2, 2013.

Date: 11/30/2013

Name: Lisa A. Piche

Address: 12 Greenwood Ct.

Who you represent: Private Citizen

Comment: There are many areas of concern in my mind after attending the 11/14 public meeting in Racine on the "Divergence" proposal. It was apparent that Waukesha is in trouble and desperate to find solutions to their water problems. This meeting wasted no time to reply to stock questions that painted a rosy picture, but failed to offer true science to back up their plan. What I did not hear was a well thought out plan to ~~utilize~~ utilize technological innovation to support their water utility and its basic infrastructure. "Pipelining" is not the answer - it is a contributor to an old mindset that needs to be admonished. Waukesha and other collaborative "water communities" could and should be working towards re-shaping and re-designing a new water utility for the future. Waukesha could be the forerunner for this paradigm shift and we can all learn from it.

"Your Comments are Important"



**WAUKESHA COUNTY
ENVIRONMENTAL ACTION LEAGUE**

Protecting Waukesha County's natural resources since 1978

November 29, 2013

Ms. Kassie Lang
Wisconsin DNR DG/5
PO Box 7921
Madison, WI 53707-7921

Dear Ms. Lang,

We are writing this letter to comment on the document entitled "City of Waukesha's Application for a Lake Michigan Water Diversion with Return Flow" dated October 2013.

In order to comment on the proposal and the proposal's compliance with the conditions of the Great Lakes Compact, and the requirements of NR 281, we've researched and consulted with experts to learn of the approaches taken by other communities facing water shortages and water quality problems around the world. Our research has led us to question the thoroughness of the City of Waukesha's water supply alternatives analysis. The City did not consider the use and re-use of storm water, gray water or treated sewage treatment plant effluent seriously, or these methods were ruled out early in the process without adequate explanation as to why, or consideration of if the method/source might work with modifications. It should be noted that the City's application has placed water conservation and the water supply alternatives analysis in separate sections of the application. There is, of course, much overlap between these topics.

The world is facing increasing water shortage issues. It is becoming increasingly obvious that the practice of using fresh, clean water once (for potable and non-potable purposes) and sending it away is completely unsustainable. Similarly, there is a growing awareness that storm water and captured rainwater can be important resources; not simply sent downstream as quickly as possible. In response, the science of water recycling and re-use is rapidly evolving.

There are currently many communities in the U.S. and the world that employ innovative and sustainable approaches to address their water quality and quantity issues. For example, storm water and wastewaters are increasingly being utilized for Direct Potable Reuse (DPR) and Indirect Potable Use (IPR). These resources are then used for water supply needs at a later date or used to augment the natural systems from which they came.

Further, non-potable water reuse is a widely accepted practice that will continue to expand to accommodate the needs of the environment and growing water supply demands.



P.O. Box 1532

Brookfield, WI 53008

(262)-253-2185

According to the EPA “Recycled water can satisfy most water demands, as long as it is adequately treated to ensure water quality appropriate for the use.” The technology exists, in fact, to treat sewage treatment plant effluent to potable use standards and this water can actually be of better quality than existing water supplies.

Water recycling and re-use is a sustainable approach that:

- while expensive initially, can be cost-effective in the long term
- avoids the significant energy expenditures and greenhouse gas emissions associated with piping water from Lake Michigan to Waukesha and back, and
- is drought-proof and unlimited

The City of Waukesha only makes passing mention of “rain barrels” in its consideration of storm water use. As stated earlier, through IPR, storm water use can go well beyond rain barrels.

The application did give “aquifer recharge” a cursory review but costs, land needs and soil-clogging were used to dismiss this option, again without adequate supporting information such as costs of what, for what; how much land would be needed, and an explanation of soil clogging and how it would fully prevent recharge, or if technology exists to mitigate it or prevent it entirely. Dr. Doug Cherkauer of UW-Milwaukee has long advocated for a balanced approach including enhanced recharge. While the cost of advanced water treatment is admittedly high, pumping Lake Michigan is also expensive and there are ongoing pumping costs (and greenhouse gas emissions) required in order to move water such great distances and back. Also, if the water was properly treated, injection wells could be considered. To date we do not believe that this option was given adequate consideration for its technical feasibility nor for its cost effectiveness over the long term.

The City also eliminated wastewater re-use from consideration early on in the process because of “multiple treatment barriers, higher health risks, higher costs and public perception.” Again, another option was eliminated with little to no explanation.

As stated previously, the technology exists to treat sewage to potable use standards. Further, we acknowledge the fact that public misperception can make it difficult to implement water recycling projects. Similar concerns and objections have been resolved in other parts of the world through early public outreach, education, and involvement in the planning process.

The City also cited “regulatory issues” when they eliminated wastewater from consideration. We agree that this is a legitimate concern, however, the DNR that is charged with Compact compliance also oversees well permitting and public water supply regulation. With the help of the WI-DNR and EPA, these barriers can and should be overcome, as they were with the PSC and conservation rate pricing. We sincerely hope that our regulatory systems can adjust themselves to allow communities to do the best and most prudent thing.



In summary, Wisconsin has long been blessed with rich water resources. This has caused many to take them for granted. The time is now for us to begin to conserve these critical and finite resources. Waukesha should take the lead in this important effort by conserving, recycling and re-using their own water resources rather than setting a poor precedent by piping in resources from another watershed. The State of Wisconsin should assist the City by undertaking the necessary regulatory reforms. The City's application for Lake Michigan water should not be considered complete until it seriously considers doing what many other communities have done: using the technological resources that are available to fully utilize their own, existing water resources.

Thank you for your consideration of these issues. If you have any questions please contact me at (262) 782-8876.

Sincerely,

Nancy Gloe,

On behalf of the Waukesha County Environmental Action League (WEAL)





1845 N. Farwell Avenue • Suite 100 • Milwaukee, WI 53202
ph 414.287.0207 • fax 414.273.7293 • milwaukeekeeper.org

December 2, 2013

Kassie Lang
Wisconsin DNR DG/5
PO Box 7921
Madison, WI 53707-7921.

Dear Ms. Lang,

On behalf of Milwaukee Riverkeeper, I am submitting comments and questions for your consideration pertaining to the return flow plans detailed in the City of Waukesha's revised application for a Great Lakes Diversion (Volume 4 of 5). We also signed on to comments from Clean Wisconsin addressing all aspects of Waukesha's proposed diversion, which were submitted on behalf of the Compact Implementation Coalition, of which we are a part.

Data extrapolation concerns

Overall, there are minimal additions of substantive information relating to return flow since the 2010 application, with most additions pertaining to projected impacts on the Root River, which is Waukesha's new preferred return flow route. While there is some new information pertaining to projected impacts on the Root River, there is also significant extrapolation of water quantity, water quality, and fisheries/habitat information from earlier analyses conducted for Underwood Creek--some appropriate and others less so. Of particular concern is absence of any Root River specific impact on habitat and fisheries conducted for this application. There is not even any desktop analysis of whether or not the fish species assemblage found in Underwood Creek and the Root River are similar and thus comparable. While the Root River and Underwood Creek share some characteristics due to their size and urban nature, there are considerable differences in watershed size, stream morphology, and land use. There is also no Root River specific analysis on shear stress and erosion potential, except for extrapolation from an earlier Underwood Creek analysis, which seems unrealistic given that Underwood Creek is concrete channelized as opposed to the Root River, and given also that the gradients, numbers of meanders, soils, and size of these watersheds differs greatly. In addition, Waukesha's new proposed return flow management scheme is drastically different than the proposed Underwood Creek regime, which would essentially divert anything over a 2-year flow to the Fox River. The new preferred Alternative (Alternative 5) would divert up to the maximum 16.7 MGD back to the Root River, and send excess waters down the Fox River. Given this change, which would send water back to the Fox River on an increased basis, there is no updated analysis on projected impacts of this alternative on flows and habitat particularly for the Fox River (other than saying that levels would be reduced by the amount of the diversion).

Another example of an extrapolation is that does not seem reasonable pertains to thermal impacts or namely that Waukesha could meet thermal regulations in NR102 and NR106 for a discharge to the Root

River by using a similar mixing zone analysis developed for the Fox River. Waukesha argues that since their return flow is not "hot", and since they were given an exemption from effluent thermal limits for a Fox River discharge based on a mixing zone study, that "thermal limits are not needed" for the Root discharge. They do state that they would do additional analysis should the application be accepted, but it seems that they should have just conducted a preemptory analysis for the Root River instead of referring to an analysis for the Fox River from Strand Associates (2011) that is not included in the application. They do state that in the absence of an acceptable mixing zone or attempts to use more site specific water quality information, that Waukesha would have other "buildable" alternatives such as treatment wetlands and multiple outfall construction that could address thermal issues. Information on Waukesha's ability to meet thermal regulations should be a part of the EIS and technical review, as State implementing regulations state that any diversion must meet state and federal laws. It seems impossible that WDNR would have enough information to make a determination at present of whether or not Waukesha's discharge could meet thermal regulations.

Data analysis concerns

There is also considerable confusion as to the data analyzed/time periods covered as one goes through the volume, with considerable variability. While we understand this could be in part due to data availability or other issues that we are unaware of, it seems that data analysis in particular relating to years of data analyzed seem to vary considerably for unknown reasons. To the casual observer, it seems Waukesha is "cherry picking" to represent the best statistics. For example, Waukesha and its consultants only looked at two years of data to assess flow rates--2005 and 2008--which were a dry and wet year, respectively. We've commented several times over the last 3+ years that this analysis did not seem suitably robust enough for Underwood Creek, but this was replicated for the Root River analysis. We also thought this analysis did not adequately consider projected climate impacts or the concern that future flows can no longer be predicted by looking solely at past flows.

It does appear that the hydraulic conditions information (Appendix K) is based on many years of data as incorporated into the SEWRPC Regional Water Quality model, but it's unclear what exact time period was used. For example, was data for the entire time range of the Regional Water Quality Management Plan used or the updated data for the Root River Watershed Restoration Plan or some combination of both? Given that only two years of data were used to look at water level impacts, it was surprising that the consultants looked at daily average and 7-day rolling average flow rates over a 49 YEAR PERIOD at each Root River USGS stream gauge when trying to justify Waukesha's claim that they will be able to meet rigorous thermal standards for the Root River (using mixing zones and dissipation of heat downstream). Why was this data set not used when coming up with water level/flow information if it was available? The water withdrawal and return flow volumes for each management plan alternative (Exhibit 4) use actual daily water demand and WWTP flow from Waukesha between 2005 and 2012, which doesn't correspond to the return flow volumes. Similarly, data for the water quality model is based on data from October 2002 through August 2009 to represent a conservative scenario based on higher flow rates and maximum discharge (Appendix M). The thermal analysis only looked at Root River effluent limits and effluent temperature data from December 2010 to March 2013 (Attachment A-5). Chloride concentrations were reviewed from March 2006 through May 2013 (Attachment A-4). It's hard to make comparisons from one appendix to another, as it seems that the information is often apples and oranges even for someone used to reading this type of data.

Water quality and erosion concerns

Waukesha currently has a variance from meeting mercury levels as well as has a compliance schedule to meet chloride levels. While Attachment A-3 (WDNR memo on likely limits for Waukesha's discharge to

return flow streams) notes that Waukesha will have to meet a new 1.3 ng/l limit for mercury, there is no information given on Waukesha's existing mercury effluent limits anywhere in Appendix A or Appendix M or anywhere else in Volume 4. Given that the return flow will discharge to Lake Michigan, which is a public water supply, this is of concern. There was some conversation about historical heavy metal contamination, but nothing other than cursory statements regarding mercury.

There is a separate appendix on chloride limits for return flow and Waukesha's compliance plan (Attachment A-4), which is very informative. The City's existing limit for discharge to the Fox River is 690 mg/L with a target value of 440 mg/L. The WDNR has intimated that the limit for a Root River discharge (or Underwood Creek discharge) would be 395 mg/L (Attachment A-3). Waukesha acknowledges that to meet this new limit, they will have to reduce chloride loading from residential and industrial/commercial customers by at least 60 percent (after looking at source reduction from the new water supply and other salt application reductions). This seems to be a very aggressive and perhaps unrealistic in the near term. Would WDNR allow for a compliance plan to meet chloride discharge limits into the Root River? Is there data on how much chloride was reduced when New Berlin and the west side of Menomonee Falls converted from well water to Lake Michigan water? It's hard to know whether these assumptions are valid or not. It's also possible that Waukesha treatment plant upgrades will address this issue, although it is unclear what those upgrades are meant to address as there is no documentation other than general references to their facility plan (Strand, 2011).

The water quality model developed for the Root River is also confusing (Appendix M). It seems that there was an analysis of water quality effects under an expected discharge condition (based on historical data) and a maximum potential discharge assuming the 16.7 MGD maximum daily water demand (which translates to around 18 cfs addition to base flow). Given that during low flows, this would constitute a 300% increase in flow, one would expect to see some major impacts on water quality at the point of discharge. Yet the data show that phosphorus would increase slightly below the return flow location and other parameters would largely be unaffected. The model also shows that largely under all scenarios and in all stream reaches, phosphorus levels are expected to remain the same or decrease. In addition, the model projects that for all months, Total Phosphorus levels will be exactly 0.075 mg/L (when other parameters vary month to month based on conditions)? Is this wishful thinking or a model limitation or why do the numbers for TP, Ortho-P, and Org N not differ on a monthly or seasonal basis? It's unclear.

The model also shows that Total Suspended Solids (TSS) will decrease essentially at all locations within the river system, which seems misleading given that sediment transport will likely occur given huge changes in baseflow volumes of the Root River. While water quality could be improved just downstream of the return flow point for some parameters such as TSS, it is likely that bank erosion and scour will also cause movement of sediment downstream, which could impair water quality and wildlife habitat (affecting areas where fish lay their eggs and macroinvertebrates live). Waukesha is proposing to discharge an average of 11.7 MGD (the daily average 10.1 MGD amount plus out of basin volumes), that is roughly an 18 cfs increase, with a 25.8 cfs increase projected for the daily maximum of 16.7 MGD. Given that at the return flow site, that the daily discharge exceeds 18 cfs about 50% of the time, that means that the discharge rate will be nearly doubled for at least half the time. This increased velocity is likely to cause erosion, especially on outside banks (there are about 10 major switchbacks according to SEWRPC and areas with steep gradient (largely negligible or under 10% of stream miles under 6% gradient according to SEWRPC for Root River restoration plan), and areas of sensitive soils. It seems that the EIS should take a better look at changes to shear stress, erosion, etc. as applied to existing Root River data (compiled by SEWRPC) and then equate that also to sediment transport (using existing MMSD models) and impacts on fish and aquatic life.

Fisheries and aquatic life concerns

In Appendix C, Waukesha states that the average maximum velocity for northern pike is 1.5-1.7 fps (based on Underwood Creek effluent return evaluation from MMSD). It then goes on in later appendices to emphasize the benefits that base flow increases will have, particularly in spring, for salmonids returning to the Root River from Lake Michigan. The return flow effects on hydraulic conditions of the Root River analysis (Appendix K) shows that at the return flow location, that river average velocities would largely fit into this range with return flow that are ideal for northern pike (used as a surrogate for other native species that aren't strong swimmers). However, velocities for return flow at the steelhead egg harvesting facility only meet this northern pike criteria during low flow and vastly exceed this criteria from the 2-year to 100-year flood scenarios yielding from 3.45 to 5.05 fps, respectively. This seems another attempt to "cherry pick" the data or "fish" to emphasize the potential benefits of return flow for salmonids, while negating or not fully considering the flow effects on northern pike and other native fish species (some of which would undoubtedly be positive). In addition, given major collapse of Lake Michigan fisheries' forage base and decreasing fish weight due to lack of food, the future of salmon stocking to Wisconsin tributaries is very much in question. Thus, benefits to these introduced species should be weighed with benefits/costs to native fish species as well.

It would seem that increased velocities and likely sediment transport could also negatively impact macroinvertebrate species as well as mussels. There is little to no info on these organisms in the Root River or even an appendix with existing HBI and IBI data (as reported by SEWRPC) in Volume 4, and these species should be more fully considered as part of the EIS and technical review. On the flip side, increased flows could help water quality parameters such as oxygen, which could be helpful in upstream portions of the Root River that have problems meeting oxygen standards and that have led to a largely pollution tolerant fisheries assemblage and fairly low HBI indexes.

Even though volumes and depth would likely increase due to return flow, which could benefit salmonid populations, it seems a bit of an over-statement that this continuous return flow would be a drastic improvement to these fisheries. Chinook and Coho spawn during the fall, and are likely impacted by low flows. Brown Trout and Steelhead spawn in both spring and fall. In addition, most salmonids respond both in spring and fall to "pulses" of flow brought about by rain events, after which salmon and trout push upstream, and it's unclear whether continuously increased flows would have a major impact lacking further analysis. Since spring flows are generally high, it is likely that return flow will not be that significant in spring either in a positive or negative way; however, there is more concern for fall spawning fish when flows are reduced.

A group of UWM students working with Tim Ehlinger (Maraijko et. al, 2013) modeled impacts of flow levels from spring of 1998 to fall of 2012 on salmonid populations in the Root River. The greatest impacts on population, although not significant statistically, were for Chinook and Steelhead populations that did show some correlation with increased flows (or return flow) during the autumn months using a linear model. However, after normalizing the data to remove bias (using a natural log based model), more conservative projections show that there were no significant population changes based on projected flow increases from Waukesha's return flow in autumn months (there was not robust data available for the other two species). Students determined that an increase of around 15 cfs would not result in a major increase in salmonid populations. Using the flow/population graphs developed by the students, there is similarly no major increase in populations of Chinook or Steelhead for an 18 - 25.8 cfs increase in flow (using numbers from revised application). The info supporting the benefits to the DNR rearing facility consist of a one page letter from Brad Eggold (Appendix L) and some cross sections of the Root River in low and high flow at the rearing facility that only show water level differences (Attachment

B to Appendix K). The purported benefits from the return flow on the rearing facility need to be better documented.

Thank you for your consideration of these comments and questions.

Sincerely,

A handwritten signature in black ink, appearing to read "Cheryl Nenn", with a long horizontal stroke extending to the right.

Cheryl Nenn
Riverkeeper

Lang, Kassandra M - DNR

From: Demaris Kenwood <pandimai@yahoo.com>
Sent: Monday, December 02, 2013 8:27 PM
To: DNR Waukesha Diversion App
Subject: public comment

Wisconsin DNR DG/5
PO Box 7921
Madison, WI 53707-7921
Attn: Kassie Lang

Dear Ms Lang and DNR,

I am opposed to the diversion of Lake Michigan water to Waukesha. I believe citizens have a responsibility to live sustainably on the earth, using their local resources with care. Diverting Lake Michigan water out of its watershed to support unsustainable growth in Waukesha is irresponsible and dangerous to the lake, whose water levels are already at historic lows due to other threats such as drainage and climate change. It is unclear what boundaries Waukesha is using to qualify for the straddling communities clause of the Great Lakes Compact and supplying water to an extended area around Waukesha to support development is unsustainable. I am concerned that Waukesha has not implemented stringent conservation measures or planned for sustainable growth before applying for a diversion, which should be a last resort, according to the Compact. I am concerned that if passed, a diversion request that does not have sound conservation and sustainability measures behind it would open the door for other US states and Canadian provinces to divert water before fully implementing conservation and sustainable growth policies.

We have only to look to the example of Las Vegas to see what the results of water diversion would be. Unsustainable growth there drained the natural springs long ago, as growth in Waukesha drew down the springs for which the area was once known. Now, the Colorado River reservoir at Lake Mead which supplies Las Vegas with 90% of its water is at historic lows and will run dry by 2021. Do we want a similar fate for Lake Michigan, on which so many people rely for drinking water, fishing, and recreation and so many plant and animal species rely for life? No! Once the water is gone, there is no getting it back.

Waukesha plans to return the used water using pipes and rivers. This too is problematic. Pipes leak with age and it is impossible to guarantee that 100% of the water drawn would be returned. Waukesha's current pipes have leaks and repairing them would be one conservation measure to turn to over constructing expensive new pipes to take Lake Michigan water. I also have concerns about the effects on the Root River ecology of returned used, treated water.

Thank you,
Demaris Kenwood
5720 North Bay Ridge Ave.
Whitefish Bay, WI 53217

Lang, Kassandra M - DNR

From: Margaret Welke <mwelke@tds.net>
Sent: Monday, December 02, 2013 8:46 PM
To: DNR Waukesha Diversion App
Subject: Comment re Waukesha's bid for Lake Michigan water

Categories: Red Category

Dear Mr. Eric Ebersberger:

Even though Waukesha falls within the GLC, I have serious reservations about selling Lake Michigan water to this community, particularly because the city has not done all it should, could and said it would do to preserve and better treat its current water resources.. This sets a bad precedent at a time when Lake Michigan's water levels are declining along with its water quality.

Margaret Welke
410 Clemons Ave
410 Clemons Avenue
Madison, WI 53704



NATURAL RESOURCES DEFENSE COUNCIL

December 2, 2013

Mr. Eric Ebersberger
Wisconsin Department of Natural Resources
101 South Webster Street
Madison, Wisconsin 53703

Submitted via email: DNRWaukeshaDiversionApp@wisconsin.gov

Dear Mr. Ebersberger,

Thank you for the opportunity to comment on the City of Waukesha's recent update to its application for Lake Michigan water under the Great Lakes–St. Lawrence River Basin Water Resources Compact (Compact). The Natural Resources Defense Council (NRDC) is a national, nonprofit, environmental organization with more than 1.4 million members and on-line activists; more than 26,000 of our members and on-line activists live in Wisconsin.

While our comments will focus exclusively on the water conservation and efficiency section of the application, we do support the comments submitted by the Wisconsin Compact Implementation Coalition, identifying a broader set of concerns with the application.

It is important to point out that Waukesha's revised application is substantially similar to the application submitted in 2010; while Waukesha's "Water Conservation Plan" was updated in 2012, no significant changes appear to have been made to that section. And, most troubling, it does not appear that Waukesha has addressed a number of questions the Department posed during its initial review of the application, including: "how conservation and efficiency measures will apply now and in the future for water users in the entire Water Supply Service Area, including those not currently receiving water from the Waukesha Water Utility;"¹ how "implemented CEMs have affected water use;"² and the additional documentation requested for the 10 percent reduction option.³

We urge the Department to continue to seek this information from Waukesha, as this information is critical to properly assessing whether or not Waukesha has met the decision-making standard in the Compact.

¹ Waukesha Water Utility, "Responses Regarding Water Conservation and Water Use Efficiency," Comment CE3, p. 1; http://www.ci.waukesha.wi.us/c/document_library/get_file?uuid=5890f364-1146-46e5-980c-b9486ecc5bbb&groupId=10113

² Waukesha Water Utility, "Responses Regarding Water Conservation and Water Use Efficiency," Comment CE6, p. 2; http://www.ci.waukesha.wi.us/c/document_library/get_file?uuid=5890f364-1146-46e5-980c-b9486ecc5bbb&groupId=10113

³ Waukesha Water Utility, "Responses Regarding Water Conservation and Water Use Efficiency," Comment CE8, p. 2; http://www.ci.waukesha.wi.us/c/document_library/get_file?uuid=5890f364-1146-46e5-980c-b9486ecc5bbb&groupId=10113

The Compact requires Waukesha to demonstrate that “no reasonable water supply alternative within the basin in which the community is located, *including conservation of existing water supplies*”⁴ (emphasis added). Wisconsin statute requires that an applicant must show that the need for the proposed diversion “cannot reasonably be avoided through the efficient use and conservation of existing water supplies.”⁵

Based on its most recent update, Waukesha has not “demonstrated” that conservation of existing water supplies cannot meet, either in full or part, its projected water supply needs, setting aside the question of whether that projected water supply need is reasonable. While Waukesha repeatedly states that water conservation measures alone cannot address its water supply needs, it does not provide the data and analysis that led to that conclusion.

We have said in other documents that Waukesha has a solid Water Conservation Plan. It has already seen success from implementation of some of the measures identified in the plan, including redefining its residential rate structure and implementing an outdoor watering ordinance. These successes, however, only point to the lack of rigor in the rest of the plan's implementation. For example, in its Water Conservation Plan, Waukesha points out that “toilet flushing accounts for approximately 30 percent of indoor water use.”⁶ And yet, from 2008-2013, Waukesha replaced approximately 249 toilets, despite a population of more than 79,000; 130 of those replacements came in 2013 (to date), after Waukesha increased the amount of its High Efficiency Toilet (HET) rebates from \$25 to \$100. For some perspective on that number, it is useful to look at how other utilities and cities have implemented similar water conservation and efficiency programs. In July 2002, U.S. EPA published a study of 17 how 17 utilities used varying water conservation and efficiency methods to reduce demand. One city profiled, Goleta, California, had a similar population as Waukesha, but it issued 15,000 rebates for high-efficiency toilets over a five-year period (1987-1991) and installed 35,000 low-flow showerheads⁷ (Waukesha's low-flow showerhead program is still in the planning process). Another city profiled, Barrie, Ontario, provided 10,500 households with 15,000 HETs over a three year period, 1995-1997.⁸ While the U.S. EPA study is dated, and it's important to acknowledge that there can be significant differences between communities, it is useful to compare the scale at which other utilities and cities have approached similar problems and to compare those results.

Finally, it is not clear how Waukesha is evaluating the effectiveness of its water conservation and efficiency programs. For example, the Water Conservation Plan recognizes that⁹:

An evaluation of cost-effectiveness is not appropriate for all CEMs. For example, public education is essential to a successful water conservation program, but water savings gained from outreach activities cannot be readily measured. Instead, the effectiveness of these activities is gauged primarily through qualitative benchmarks such as customer satisfaction, changes in customer water use behaviors, and knowledge gained.

⁴Great Lakes-St. Lawrence River Basin Water Resources Compact,” December 13, 2005, p.16; http://www.cglg.org/projects/water/docs/12-13-05/Great_Lakes-St_Lawrence_River_Basin_Water_Resources_Compact.pdf

⁵ Wisconsin Statute §281.346(4)(f)1; <http://docs.legis.wisconsin.gov/statutes/statutes/281/III/346/4/f/1>.

⁶ Waukesha Water Utility, “Water Conservation Plan,” July 2012, p. 1-2;

http://www.ci.waukesha.wi.us/c/document_library/get_file?uuid=4312880e-46ef-4402-9cf5-43277d0dfd0&groupId=10113

⁷ U.S. Environmental Protection Agency, “Cases in Water Conservation: How Efficiency Programs Help Water Utilities Save Water and Avoid Costs,” p. 19-20, July, 2002; http://www.epa.gov/WaterSense/docs/utilityconservation_508.pdf

⁸ Ibid, p. 47-48.

⁹ Waukesha Water Utility, p. 6-7.

We agree that cost-effectiveness is not necessarily an indicator, in and of itself, of the effectiveness of a particular CEM. However, it is not clear to what degree Waukesha is using the evaluation factors cited for its existing programs, particularly its public and school education and information programs. For example, Waukesha has provided tens of thousands of fifth graders with water conservation information over the past years; can they track any changes in customer water use behaviors as a result? Youth education is a critical part of water conservation, which is why understanding the effectiveness of a particular approach is all the more important.

Thank you for considering these comments.

Sincerely,

Karen Hobbs
Senior Policy Analyst
312-651-7915
khobbs@nrdc.org

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Wisconsin Wildlife Federation*

Mr. Eric Ebersberger
Wisconsin Department of Natural Resources
101 S. Webster St. Madison, WI 53703
VIA EMAIL (sent to DNRWaukeshaDiversionApp@wisconsin.gov)

December 2, 2013

Re: The Compact Implementation Coalition's comments on Waukesha's Diversion Application

Dear Mr. Ebersberger,

The undersigned organizations, collectively representing tens of thousands of Wisconsinites, thank you for the opportunity to comment on Waukesha's revised application for a diversion of Great Lakes water under the Great Lakes Compact. Collectively, we have a long history of working on this issue. From ensuring the adoption and implementation of a strong Great Lakes Compact to aiding the Department in the promulgation of administrative rules to implement the Compact, we have consistently advocated for the strongest protections available for the resource, in keeping with the spirit and the letter of the Compact.

Waukesha's application is historic. As the first ever application of its kind, it will set a precedent for similar future requests under the Compact. Because the Great Lakes are an invaluable local, national, and global natural resource, Waukesha's precedent-setting application deserves the highest degree of scrutiny for meeting the standards established in the Compact. Unfortunately, the Compact Implementation Coalition believes that Waukesha's diversion application does not meet several key standards set forth in the Compact, codified in Wis. Stat. §281.343-346, and therefore is not approvable.

Waukesha's revised application is substantially similar to an application that was submitted to the Department in 2010 and updated at the Department's request in the ensuing years. Over the past three years, our organizations have repeatedly expressed our concerns with Waukesha's proposal, both formally and informally, to Department staff. To the extent that the revised application contains the same or substantially similar information, plans, requests, or proposals for the Department to consider, these comments are meant to reference and build off of our past comments. With regard to the general proposal as described by Waukesha and their underlying assumptions and data, our position is unchanged with the submission of the revised application: we oppose approval of the application as submitted.

Waukesha has applied for a diversion of Great Lakes water as a community within a straddling county under Wis. Stat. §281.346(4). Six critical areas in which Waukesha's revised application fails to meet the approval criteria under Wis. Stat. §281.346(4) are:

- I. Waukesha has not considered all reasonable alternatives.
- II. The application fails to define a "community within a straddling county" that meets the need requirements established under the Compact and under Wisconsin law.

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- III. The application fails to show that Waukesha has offset the need for the diversion to the greatest extent possible by maximizing the use of existing water resources and minimizing additional need through water conservation and efficiency measures.
- IV. The application's proposed approach to diverting water from and returning it to Lake Michigan fails 1. to minimize the amount of water from outside the Great Lakes basin that would be returned to the source watershed and 2. to return an amount of water to the basin equal to the amount withdrawn (less an allowance for consumptive use).
- V. The application fails to show that the returned water will be treated to meet applicable permit requirements under s. 283.31.
- VI. The application fails to show that there will be no significant adverse environmental impacts to the waters of the state resulting from the new or increased withdrawal.

The Wisconsin Department of Natural Resources has a duty to ensure that the criteria set forth in Wis. Stat. §281.346 are met to the letter of the law before approving the application. The Great Lakes Compact and Wisconsin law both make clear that the exception under which Waukesha applies for a diversion is only to be used in extraordinary circumstances: "Caution should be used in determining whether or not the proposal meets the conditions for this exception." Wis. Stat. §281.343(4n)(c)e. The Department can expect that an approval of the application will be reviewed with the highest level of scrutiny by interested stakeholders at the state, regional, national, and international level, in addition to review by the regional body. As such, the Department's review should ensure that any decision on the application is defensible and based on sound science. We submit that the current application will not pass that level of scrutiny.

I. Waukesha has not considered all reasonable alternatives.

The Great Lakes Compact's standard is clear. In order for a community within a straddling county to qualify for a diversion of Great Lakes Water, the basic threshold question that they must prove is that there is "no reasonable water supply alternative" for the community. Wis. Stat. § 281.346(4)(e)1.d. Waukesha has failed to show that there is no reasonable water supply alternative.

One set of alternatives that Waukesha has not considered are those based on diverting a smaller amount of water than requested in their application. For example, they did not conduct analyses of the amount of water needed to supply only its *current* service area in future scenarios including aggressive conservation and/or peak demand reduction practices. Sources of water supply for these alternatives could include the current mix of deep and shallow-aquifer wells, the addition of new shallow wells or quarry water, or a wholesale switch to a small number of riverbank inducement wells, to name only a few.

Until Waukesha has evaluated these and potentially other alternatives available to it and shown that those alternatives are not "reasonable" under the standards set forth under the Compact, Waukesha has not adequately demonstrated that there is "no reasonable water supply alternative" as required under Wis. Stat. §281.346(4)(e)1.d.

II. The application fails to define a “community within a straddling county” that meets the need requirements established under the Compact and under Wisconsin law.

Waukesha has applied for a diversion as a “community within a straddling county” as provided under Wis. Stat. §281.346(1)(d) and (4). A “community within a straddling county” is defined in the statute as “any city, village, or town that is not a straddling community and that is located outside the Great Lakes basin but wholly within a county that lies partly within the Great Lakes basin.” There is no dispute that the City of Waukesha meets this definition because it is a “city, village or town.” However, the application seeks to include an entire proposed (and as-yet unapproved) water supply service area for Waukesha’s Water Utility as part of the diversion request. This unapproved planned service area includes portions of four additional communities within a straddling county, none of which can meet the exception standard under s. 281.346(4)(f).

The Compact does contemplate the idea that more than one community may receive water under a single diversion application under Wis. Stat. §281.346(4). However, as the statute states, “[i]f the proposal is to provide a public water supply within more than one city, village or town... any portion of the proposal that provides a public water supply within a community described in par. (e)1. (intro) is subject to par.(e).” Wis. Stat. §281.346(4)(bg)2.

Thus, each of the five communities that are applying for the diversion under consideration must establish that it meets the requirements of Wis. Stat. §281.346(4)(e). The communities included in Waukesha’s application have made no such showing. It is not clear whether the other communities implicated in this application are applying for a straddling community diversion along with the City of Waukesha. Thus, the portion of the diversion request pertaining to those communities must be denied.

III. The application fails to show that Waukesha has offset the need for the diversion to the greatest extent possible by maximizing the use of existing water resources and minimizing additional need through water conservation and efficiency measures.

In order for Waukesha to receive an approval for its diversion application, it must prove that the need for the proposed diversion “cannot reasonably be avoided through the efficient use and conservation of existing water supplies.” Wis. Stat. §281.346(4)(f)1. This requirement is further defined by Wis. Admin. Code NR 852, which requires Waukesha to complete certain mandatory and required water conservation and efficiency measures, and then to identify additional measures that are “cost-effective or environmentally sound and economically feasible” and implement them before applying for a diversion. NR 852.06(1).

While Waukesha’s application clearly states its conservation plan and goals, it does not establish:

1. Whether the conservation plan comports with industry best practices;
2. Exactly how much additional water Waukesha needs to solve its immediate radium contamination problem;
3. Exactly how much water the utility could save on an annual basis if its current conservation plan were implemented more aggressively;

4. Exactly how much water the utility could save on a per year basis if it adopted the most aggressive conservation program, which could yield "saved" water as a reasonable source of water supply going forward and must be evaluated in that way.

In order for Waukesha to prove that it cannot reasonably avoid the need for a diversion through conservation, it must show data to support its assertion, not merely state that it cannot be done. The undersigned request that the Department take a close look at Waukesha's proposal and verify all of the assumptions regarding Waukesha's analysis of future use and need and achievable savings through conservation, in addition to considering whether Waukesha has failed to consider reasonable water supply alternatives that would entail aggressive investment in water savings to help meet both the radium requirements and future water needs for the City.

- IV. **The application's proposed approach to diverting water from and returning it to Lake Michigan fails 1. to minimize the amount of water from outside the Great Lakes basin that would be returned to the source watershed and 2. to return an amount of water to the basin equal to the amount withdrawn (less an allowance for consumptive use).**

Wis. Stat. §§281.346(4)(e)1.c and 281.346(4)(f)3 are critical requirements that minimize the potential environmental impacts and risks associated with a diversion, on both the Great Lakes basin and the adjacent basin, to which a diversion is proposed. These require having as close to 100% of the water returned to the Great Lakes basin originate in the Great Lakes, and having a volume as close as possible to 85% of the water withdrawn returned to that basin (assuming Waukesha's claimed 15% consumptive use). Waukesha's preferred return flow management plan does not meet either of these requirements, and Waukesha has failed to demonstrate an alternative return flow management plan that would meet them.

One action that must be undertaken to meet these requirements is that Waukesha would have to take steps to address the high levels of infiltration and inflow (I/I) in its water supply and sanitary sewer systems. Partly as a result of this I/I, the return flow management alternative that comes closest to meeting the requirements of §281.346(4)(e)1.c would have a return flow made up of 10-15% "out-of-basin water," despite estimates of waste-water-only customers (the non-I/I contribution of out-of-basin water) at only 1.4 – 1.6%. Similarly, the return flow management alternative would that comes closest to meeting §281.346(4)(f)3 would return an amount of water corresponding to 94-100% of the water withdrawn , where the required return rate would be 85% based on Waukesha's assumed 15% consumptive use.

Far from identifying a return flow management alternative that would meet statutory requirements, Waukesha proposes to use a return flow management plan that features 24-44% of return flow originating from outside of the Great Lakes basin, and a return amount of 112-152% of the volume withdrawn on average.

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V. The application fails to show that the returned water will be treated to meet applicable permit requirements under s. 283.31.

The Compact requires that if water will be returned to the source watershed through a stream tributary to one of the Great Lakes, the physical, chemical, and biological integrity of the receiving water under subd. 3. must be protected and sustained as required under Wis. Stats. §§ 30.12, 281.15 and 283.31, considering the state of the receiving water before the proposal is implemented and considering both low and high flow conditions and potential adverse impacts due to changes in temperature and nutrient loadings. Wis. Stat. § 281.346(4)4s. Waukesha's application proposes to discharge effluent into the Root River, which is listed on the Department's current and pending 303(d) lists as impaired for both Phosphorus and Total Suspended Solids. In order to discharge in to an impaired waterway, the permittee must show that the discharge will improve water quality. Wis. Admin. Code NR 217.13(8)(b) In addition, Waukesha must show that its discharge would meet relevant Great Lakes Basin water quality standards for all pollutants. The Department must conduct a thorough analysis as a part of the Environmental Impact Statement to show that Waukesha's discharge can meet the standards set forth in Wis. Stats. §§ 30.12, 281.15 and 283.31.

VI. The application fails to show that there will be no significant adverse environmental impacts to the waters of the state resulting from the new or increased withdrawal.

Wis. Stat. §281.346(f)5 and §281.346(6)(b) require that a proposed diversion will "result in no significant adverse individual impacts or cumulative impacts to the quantity or quality of the waters of the Great Lakes basin or to water dependent natural resources, including cumulative impacts that might result due to any precedent-setting aspects of the proposed diversion, based upon a determination that the proposed diversion will not have any significant adverse impacts on the sustainable management of the waters of the Great Lakes Basin." In addition to an analysis of the impacts to the Great Lakes Basin and its tributary waters, the Department must include in its environmental impact statement an analysis of the impacts to the Fox River basin that would result from the proposed diversion.

For the foregoing reasons and those our coalition has communicated to the Department in the past, the undersigned organizations believe that Waukesha's diversion application cannot be approved as submitted. We encourage Department staff to contact us should they wish to discuss these or any past comments submitted by the Coalition on this matter. Thank you for your consideration of our input and for providing this written comment opportunity for all stakeholders and interested members of the public.

Sincerely,

Mark Redsten, Clean Wisconsin

Jodi Habush Sinykin, Midwest Environmental
Advocates

Cheryl Nenn, Milwaukee Riverkeeper

Laurie Longtine, Waukesha County
Environmental Action League

George Meyer, Wisconsin Wildlife Federation

Lang, Kassandra M - DNR

From: Stevan.Keith@milwcnty.com
Sent: Tuesday, December 03, 2013 4:17 PM
To: DNR Waukesha Diversion App
Subject: Comment/Question on Waukesha Water Diversion App

Categories: Red Category

To: Kassi Lang

I have one comments and one question related to the application, for your consideration during assessment.

Comment 1:

Appendix A of Volume 3 of the application titled Waukesha Water Utility Water Conservation and Protection Plan (2006) includes a number of recommendations, many of which appear to have been implemented by the City of Waukesha. That plan also included recommendations to modify Waukesha's planning and zoning ordinances to conserve water and enhance stormwater infiltration, but there is no mention of such changes having been adopted in the main body of the application. A comprehensive review of codes and ordinances, beyond the lawn watering restriction, could help reduce long-term demand.

Comment 2:

If the Waukesha application is approved, will the added loading from the new discharge reduce (what would have been) the TMDL waste load allocation (if not permitted) for the MS4 permit holders upstream of the point of discharge?

Regards

Steve Keith, P.E.
Sustainability & Environmental Engineer
Milwaukee County
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Milwaukee, WI 53208
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Lang, Kassandra M - DNR

From: sohlman53108@gmail.com
Sent: Tuesday, December 03, 2013 4:35 PM
To: DNR Waukesha Diversion App
Subject: Waukesha Water and Root River Return Route

Categories: Red Category

I request that you include this e-mail as part of your review regarding Waukesha plan to get water from Oak Creek only to DUMP it on Racine County.

If Waukesha is getting water from Oak Creek why isn't Oak Creek required to accept the returned water?

If I buy something from the store and need to return it where does one go to do that? The store (or chain) that sold it to me or a competitor?

Do you dump your garbage on someone else's lawn.

And why is it that Oak Creek, Waukesha, and Franklin seem to be OK with just DUMPING something like 19,000,000 gallons a day. Consider this: if this were any other chemical the Federal EPA would be all over this. But instead we have three wealthy communities in another county who are deciding to pump unmonitored wastewater from Waukesha to Franklin and dump it into a Franklin waterway in a location where it will flow fairly quickly into a wholly different county.

Already much of the Root River route floods during heavy periods of rain.

Please review USGS statistics and information at <http://waterdata.usgs.gov/usa/nwis/uv?04087220>

On Oakwood Road just below Hwy 100, there are already gates in place that say Road Closed. I'm sure Franklin has a record of how many times they have had to close Oakwood Road due to flooding. They have raised the road slightly in recent years but that has not solved the problem entirely: they still close the road. This impacts commuter traffic as well as access to Wheaton Franciscan hospital on Oakwood and 27th. What happens when you add those millions of gallons of water to the mix when there's nowhere for the water to go?

South 27th Street merges with I-94 at the county line. This area is prone to flooding as well. I have never personally seen flooding on the little bridge that connects 27th Street over the Root River. This route, however, is sometimes used to divert northbound traffic off the interstate when there are accidents in the northbound lanes of I-94. That won't work so well if that river is flooded. To rebuild the bridge would be quite costly.

Is Oak Creek going to foot the bill for that?

Is Waukesha going to foot the bill for that?

Is Franklin going to foot the bill for that?

Racine shouldn't have to foot the bill for that!

Taxpayers shouldn't foot the bill for that!

Is Oak Creek, Waukesha or Franklin going to buy up the Racine County homes which will be subject to flooding because of this plan along neighboring County Line Rd from that bridge on 27th St?

What has Waukesha done to mitigate its water needs that they've known about for years?

- A. Discourage or at least limit development permanently?**
- B. Encourage native grass perimeters instead of water-hungry turf grass permanently?**
- C. Put watering restrictions in place permanently?**
- D. Restrict pools permanently?**

OR

- E. None of these.**

Waukesha has done nothing but whine for years instead of planning. They have allowed unfettered development.

And now they want to shove their wastewater into someone else's backyard.

I will fight this plan tooth and nail and will make sure Federal Agencies get involved

if you turn up powerless and/or unwilling to force the communities with the inflow to fully handle and contain the outflow.

The plan as proposed will never see the light of day until those communities agree to return it using the same path they got it.

All it takes a few letters to a bunch of Washington, D.C. agencies and this plan will go, as they say, down the tubes.

Please tell Waukesha "Don't plan to dump your garbage on someone else's lawn."

Scott Ohlman

2311 Waukesha Rd – about 6 miles south of Ryan Road

Caledonia, Town of Raymond, Racine County, WI 53108

262 835 9215

waukeshawater@o-k-corral.com

Lang, Kassandra M - DNR

From: Lang, Kassandra M - DNR
Sent: Wednesday, December 04, 2013 10:09 AM
To: DNR Waukesha Diversion App
Subject: FW: Waukesha Diversion comments

Categories: Red Category

From: Ebersberger, Eric K - DNR
Sent: Tuesday, December 03, 2013 4:05 PM
To: Lang, Kassandra M - DNR; Pfeiffer, Shaili M - DNR; Clayton, Nicole L - DNR; Fuchsteiner, Christopher J - DNR; Smail, Robert A - DNR
Subject: FW: Waukesha Diversion comments

FYI

From: Helen Sarakinos [<mailto:hsarakinos@wisconsinrivers.org>]
Sent: Tuesday, December 03, 2013 3:59 PM
To: Ebersberger, Eric K - DNR; Denny Caneff
Subject: Waukesha Diversion comments

Eric,

Yesterday (Dec. 2), the Compact Implementation Coalition (CIC) sent to the DNR comments on Waukesha's application for a Lake Michigan Diversion, outlining six critical areas in which Waukesha's revised application fails to meet the approval criteria under Wis. Stat. §281.346(4). The comments sent to DNR yesterday included the River Alliance of Wisconsin as one of the signatories. Given the chaos of the long weekend prior to comment deadline, there was a miscommunication and River Alliance of Wisconsin had not intended to sign on to those comments as they are drafted.

We ask that you **not** consider us as one of the signatories to these comments. It is important to note, however, the River Alliance shares many of the same concerns as the Compact Implementation Coalition but, in this case, there are two points that we would like to highlight where there is divergence.

We agree entirely with the assessment that Waukesha's application fails to meet the approval criteria under Wis. Stat. §281.346(4) in **four of the six** listed areas. Specifically, we agree that:

- I. Waukesha has not considered all reasonable alternatives.
- II. The application fails to define a "community within a straddling county" that meets the need requirements established under the Compact and under Wisconsin law.
- III. The application fails to show that Waukesha has offset the need for the diversion to the greatest extent possible by maximizing the use of existing water resources and minimizing additional need through water conservation and efficiency measures.

And,

IV. The application's proposed approach to diverting water from and returning it to Lake Michigan fails 1. to minimize the amount of water from outside the Great Lakes basin that would be returned to the source watershed and 2. to return an amount of water to the basin equal to the amount withdrawn (less an allowance for consumptive use).

We diverge with the opinion of the CIC on the two remaining areas addressed:

V. The application fails to show that the returned water will be treated to meet applicable permit requirements under s. 283.31.

The River Alliance remains deeply concerned that additional discharge to the already listed Root River will not further degrade water quality of the River. Waukesha Water Utility stated publicly in its November 2013 public meeting in Racine that it intends to meet the WQBELs from day 1 of its discharge should it proceed with that alternative. As the application stands currently, we do not see how this fails to meet applicable permit requirements. We do, however, share the CICs concern about the high rates of I/I and the volume of non-Lake Michigan water that will be channeled back to the Great Lakes Basin. We urge DNR to remain vigilant in assessing what adequate water quality criteria should be and in enforcing them.

VI. The application fails to show that there will be no significant adverse environmental impacts to the waters of the state resulting from the new or increased withdrawal.

This point is raised in regards to impacts to the Fox River which lies in the Mississippi River Basin. We also urge the DNR in its EIS to weigh the environmental impacts to the Fox River of this change in effluent discharge and to determine the environmental costs. However, our reading of the statute, Wis. Stats. §281.346(f)5, and §281.346(6)(b). requires that a proposed diversion will "result in no significant adverse individual impacts or cumulative impact to the quantity or quality of the waters of the Great Lakes basin. Impairment to the Fox River I a big concern but we do not feel that technically it puts Waukesha Water Utility in violation of meeting the exception standard. It may trigger issues with other state statutes such as Chapter 30 and so we request that DNR look at the impact in the EIS.

In closing, our differences lie largely in the interpretation of which of the listed concerns are directly in conflict with the Compact diversion approval criteria and which are broader concerns that need to be addressed in the EIS and in rigorous enforcement. However, our issues substantively mirror those of the CIC.

Please let me know if you have any questions

Sincerely,
Helen Sarakinos

Water Policy Program Director
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